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This Week

All the way from the Greek derivation of the word to omega, the use of the stroboscope in automotive research is described in a most interesting way on page 760. All the different types of instruments are described and well illustrated by diagrams and photos.

Some interesting new ideas have come over the horizon recently. The trend of the inventive minds can be gleaned from page 668.

The specifications of the cars up to the very last minute are shown on page 672. There are several important changes.

April Output Passed Half-Million; No Let-Down Expected Before June

May Production to Equal April's; Monthly Average Since New Models Were Introduced 394,000 Units

That motor vehicle production last month cleared the 500,000 unit mark by a comfortable margin is evident from a compilation of final output figures of the principal manufacturer. April thus established a new monthly high since the record year 1929, easily topping the 1935 peak reached in April when, for the first time in six years, production crossed the half-million mark.

Until the official industry figure is available, the closest estimate of car and truck production in the U. S. and Canada last month stands at 515,000 units which compares with 442,554 vehicles in March and 501,812 in April, 1935. Last month's achievement was significant in that this high level was reached in the seventh month of current model production and in the face of the stabilization program adopted by the manufacturers which tended to keep production on a more even keel.

Had no attempt been made to level the seasonal peaks by advancing the announcement date for new models, as was done this year, it is obvious that the factories now would be swamped with business far beyond capacity. And if capacity could have been stretched sufficiently, there is little doubt but that the spring peak this year would have rivalled the all-time record year of 1929 when production in the peak month of April reached 663,811 units.

As it was, the plants got under way on present lines last October and since then production has averaged over 394,000 units monthly, ranging from 283,337 in the first month to the estimated 515,000 units in April. Ignoring the

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AMA Output Up 19%

The Automobile Manufacturers Association reports member output for April at 388,165 units, a gain of 19 per cent over the 327,040 units produced in March and 26 per cent above April a year ago when production totaled 306,898. For the first four months, production totaled 1,212,242 units compared with 1,011,833 for the same period last year. This represents a gain of 20 per cent and is the largest output any year since 1929.

Close Harmony in New Union

Conservatives, Outvoted in U. A. W. Convention, Give Way to "Progressives" but Promise Continued Support

With the progressive element in full control, the United Automobile Workers International Union closed its convention in South Bend last week a materially strengthened organization, bent on bringing its membership up to the 100,000 mark by the time of the next annual convention which is to be held in Milwaukee the last week of August, 1937.

What gave the new union greater strength was the disposition of controversial issues in a manner satisfactory to the majority of members and the overwhelming strength demonstrated by the progressive faction which rendered futile any efforts on the part of the conservatives to wage battle for their cause. Ending of the probationary period by the American Federation of Labor removed a chief point of dispute, a matter that had irritated a big percentage of the membership and, as many believe, stood in the way of effective organization work. Definite alignment of the International with the John L. Lewis Committee for Industrial Organization contributed further toward unity since most of the members favor the industrial form of organization.

It was easy to see that the desire for harmony was uppermost in the minds of the assembled delegates who realized that unity was essential to the organization's growth if not its very existence. In fact, harmony was the key-note of every speech made at the convention. Even the retiring president, F. J. Dillon, pledged to the insurgents, who had unseated him, his cooperation "wherever I may be and whatever I may be doing."

Affirming his interest in the future success of the automobile union and promising to "do anything to contribute to unity," Dillon immediately proceeded to make good by withdrawing from the affairs of the convention, feeling that his presence as leader of the minority conservatives might be a source of discord. His action exemplified the spirit of the meeting.

Dillon took his defeat in good grace, delivering an impressive valedictory before he yielded the gavel to his successor. Facing a hostile gathering, he won by sheer force of personality and forensic ability the plaudits of his opposition, and left the assembly a far more popular man than when he opened the first session.

His retirement removed from organized labor in the motor industry a forceful, but conservative leader, with

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New Earnings Records

Hudson's Largest, Mack's First Since 1930; GM Pays Extra

First quarter earnings for the Hudson Motor Car Co. totaled $592,827, after all charges except provision for Federal taxes. This is the highest first quarter for the company in the past six years, and is higher than any quarter since 1930, with the exception of the last three months of 1935.

Reporting a first quarter profit for the first time in at least five years,

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Only False Advertising Hit

Senator Wheeler Says His Bill, Giving Added Powers to the F.T.C., Is Not Aimed at "Puff" Publicity

"Puff" advertising will not be affected by the Wheeler bill which passed the Senate last Monday, according to the author of the bill, but provable misrepresentation or fraud in advertising will be subject to the measure. To explain the distinction, Senator Wheeler referred to automobile advertising. He said that the courts have recognized the difference between simply "puffing" one's own product in a general statement, such as: "It is the best car manufactured," and misrepresenting a definite feature of the product. "If an automobile manufacturer said, 'This automobile has a self-starter on it,' when as a matter of fact it did not have one, that statement would be a definite, positive misrepresentation of a provable fact," explained Senator Wheeler.

While the Wheeler bill would broaden considerably the power of the Federal Trade Commission, one of its most objectionable features, from the standpoint of industrialists, was removed by the action of the committee on interstate commerce, headed by Senator Wheeler, in striking out a vital provision. This clause would have conferred on the Commission "so much of the auxiliary power of Congress to obtain information in aid of legislation as may be necessary to enable the Commission to carry out" the powers granted it by legislation. This provision would apparently have made the Commission a part of Congress itself—in a way, a third branch of the Federal law-making body.

The bill as finally passed by the Senate gives wide powers of investigation and enforcement to the Federal Trade Commission. It authorizes the Commission to investigate, upon the direction of the President, either branch of Congress, or on its own initiative, the organization, business conduct, practices and management of any person, partnership or corporation engaged in commerce, excepting banks and common carriers subject to the Act to Regulate Commerce, and their relation to other individuals, partnerships and corporations. The Commission may investigate trade conditions in foreign countries where associations, combinations or practices may affect the foreign trade of the United States, and report on these, with recommendations, to Congress. It may also report any facts relating to alleged violations of the anti-trust acts.

Appeal from cease and desist orders may be made to the Circuit Court of Appeals, to which the Commission may likewise appeal for enforcement of its orders.

Senator Wheeler, replying to attacks in the press on the measure, insisted that it is a re-enactment of the present law with comparatively few amendments made for the purpose, not of adding to the powers of the commission, but of aiding it to carry out its present powers. The bill passed the Senate without a dissenting vote, and is not expected to encounter resistance from the House when it comes before the latter.

Last week the Senate passed the Robinson "price discrimination" bill after adopting an amendment offered by Senator Vandenberg of Michigan exempting industrial production from its provisions.

Tire Prices, Wages Are Up

Industry Boosts Retail List from 5½ to 13 Per Cent While Plant Workers Get 5 to 10 Per Cent More

Led by the major manufacturers, the tire industry last Monday advanced prices from 5½ to 13 per cent. The advance came just a few hours before wage increases of 5 to 10 per cent for plant workers were announced by Firestone. This move was promptly followed by Goodrich, Goodyear and General, though amounts were not specified.

Increases in the four major Akron plants affected 50,000 workers and will add $350,000 to the monthly payroll.

The move came close on the heels of a May Day organized labor demonstration, said to be the greatest in Akron's history. Observers believe the wage increase may be the cause of averting an industry - wide strike which has threatened since the termination of the six-week strike at Goodyear.

It is expected that the move will increase the manufacturer's own net recovery by about five per cent, due largely to the fact that the prices of raw material were already up, and had not been offset by corresponding increases in the selling price.

The price advances are worked out on the basis of a mythical price list posted under the NRA in November, 1934, which specified prices in percentage of list for different grades. Now, first line tires are raised from 90 to 100 per cent of this list, or an 11 per cent increase; second line tires from 77½ to 90 per cent, an increase of 13 per cent; third lines from 66½ to 70 per cent or 5½ per cent increase; and fourth lines from 61 to 65 per cent or an advance of 7½ per cent.

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British Road Tester

Twelve-Ton Truck Runs at 40 m.p.h. Over Trial Track

With a highway budget of £60,000,000 a year, the department of Scientific and Industrial Research of the British government makes thorough studies of all problems concerned with road building and upkeep.

A large road-testing machine has just been completed at the Road Research Laboratory at Harmondsworth. It consists of a circular track on which runs a 12-ton truck, tethered to the end of a rotating boom and driven by a 180 hp. electric motor supplied with current by cables running along the boom. The diameter of the track is 110 ft. and the maximum speed at which the truck runs is 40 m.p.h. The centrifugal force at this speed, it has been calculated, is so great that if the truck were to break loose it would have the momentum of a 6 in. shell.

There are also two smaller road-testing machines while a special plant has been installed for laying test roads.

Wide World photo

"Merry-go round" 12-ton truck used to test road surfaces in the British laboratory at Harmondsworth

International photo

"Eddie" Rickenbacker, ex-race driver, World War flying ace, and now vice-president of North American Aviation, Inc., was guest of honor at a dinner given by the S.A.E. Metropolitan Section at the Waldorf-Astoria Hotel in New York May 1. Left to right: Mr. Rickenbacker, Mrs. John F. Winchester, wife of the chairman of the Metropolitan Section and manager of the General Automobile Department, Standard Oil Co. of N. J., and Merrill C. Horine, toastmaster of the evening, and sales promotion manager of Mack Trucks, Inc.

Foundrymen Meet in Detroit

Research Work on Alloy Cast Irons High Spot of Papers Read at A.F.A. Convention

Thousands of foundrymen and metallurgists from all over the United States thronging to Convention Hall in Detroit assured the success of the fortieth annual convention of the American Foundrymen's Association and the Foundry and Allied Industries Exposition which ran concurrently. The Detroit chapter of the A. F. A., whose chairman is Vaughan Reid, president, City Pattern Works, served as host to the visiting delegations.

An imposing list of technical papers, featuring some of the best-known names in the metallurgical art, packed the meeting halls. Greatest emphasis was placed upon current research work on alloy cast irons, at least five papers being devoted to various phases of the subject. J. E. Hurst, director of Sheepbridge Stokes, England, prepared a paper on the heat treatment of cast iron, while Marcel Ballay and Raymond Chavy, of Paris, discussed the applications of heat-treated cast irons in France.

One of the most unusual contributions to the literature was a committee report presented by six of the leading metallurgists of the automotive industry giving in tabular form the physical and chemical characteristics of alloy cast irons for specific applications. The two other papers of this group dealt with fatigue properties of cast iron and copper and copper manganese gray cast iron respectively.

Among the other high spots of the technical sections were: A correlated abstract on manganese bronzes by Dr. F. R. Hensel of P. R. Mallory and Co.; the conference on apprentice training with S. W. Utely, Detroit Steel Castings Co., in the chair; and prepared papers by H. W. Boulton, Murray Corp.; F. R. Hoadley, Farrel-Birmingham Co., and J. G. Goldie.

The annual banquet held Thursday evening headlined W. J. Cameron, Ford Motor Co.

Equipment at the exposition was shown in over 200 separate exhibits. Among the prominent exhibitors were the International Nickel Co., Bethlehem Steel, Ford Motor Co., Fruehauf Trailer, Macklin Co., Climax Molybdenum, Vanadium Corp., Norton, Carborundum, Detroit Electric Furnace, Eaton-Erb, and many others. The Wheelabrator, the new airless abrasive cleaning process, was exhibited in a number of its varieties by the American Foundry Equipment Co. Conveyor and foundry equipment was shown by Link-Belt, Chain Belt, Bartlett-Snow, Jeffrey Matthews, Standard and others.

James L. Wick, Jr., president and general manager, Falcon Bronze Co., Youngstown, Ohio, was elected president of the American Foundrymen's Association at the annual business meeting of that organization on Thursday, May 7, in Detroit. This honor comes to Mr. Wick after a long career of distinguished service to the foundry industry and in the affairs of the A. F. A. Prior to his election to the presidency he was vice-president and chairman of the Divisional Activities Correlation Committee.

Hyman Bornstein, director of the testing and research laboratories, Deere & Co., Moline, Ill., was elected vice-president of the association. Dan M. Avey, editor of *The Foundry*, who has just completed two terms as president, was elected a director. Others who were elected directors of the association are: Carl C. Gibbs, president of the National Malleable & Steel Casting Co., Cleveland; Marshall Post, vice-president, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; James R. Allan, International Harvester Co., Chicago; and Lester N. Shannon, vice-president, Stockham Pipe Fittings Co., Birmingham, Ala.

Officers of the United Automobile Workers Union elected at the South Bend convention last week. Left to right: Wyndham Mortimer, Cleveland, first vice-president; Edward Hall, Milwaukee, second vice-president; Homer Martin, Kansas City, president; Walter N. Wells, Detroit, third vice-president; and George Addes, Toledo, secretary-treasurer.

New Canadian Motor Tariffs

Intermediate Rates Are Lower on U. S. Imports, But Excise Tax Is High on More Expensive Models

The tariff revisions made by the Canadian Minister of Finance, and put into effect on May 2, have brought about important changes affecting automotive trade between Canada and the United States. With the expressed aim of bringing about lower prices for the Canadian consumer, the new provisions have caused no little concern among Canadian producers. In order to clarify the situation, the major classifications of the new tariff are outlined in the following paragraphs:

The intermediate tariff applies to countries that are accorded "most favored nation" ranking, including the United States. Under the old arrangement, cars imported from the United States were subject to a tax ranging from 17½ per cent on cars under $1,200 up to 30 per cent on cars over $2,100 in value. Under the new schedule the 17½ per cent rate applies to all cars.

However, a new excise tax is levied on all cars, both domestic and foreign, valued at more than $650. This amounts to a 5 per cent tax on the value in excess of $650, but may not exceed $250 for any one car. In addition there is a 3 per cent import excise tax levied on cars imported from the United States valued at $650 or more. It is of note, however, that the low-priced, standard models come in entirely free of the excise tax and it is said that the net change in tariff on highest priced cars amounts to a reduction of 3 per cent.

A general tariff, applying to countries other than British which do not fall within the intermediate group, has been established at the uniform rate of 27½ per cent, replacing the former range of from 20 to 40 per cent.

A revision has been made in the list of parts items which may be imported duty free and a sliding scale system, based on percentage of British content, has been devised in order to encourage Canadian manufacture.

Under the established system, many parts from the U. S. are subject to an intermediate duty of 20 per cent and a general tariff of 30 per cent. But if the manufacturer keeps his British content above 50 or 60 per cent (depending on the size of his operations) he may import the parts duty free in the intermediate class and 25 per cent under the general rates. Chassis frames fall into this classification.

In addition, there is also a British preferential impost which applies to the entire British Empire, and which is materially lower than either the intermediate or general imposts.

Tires and tubes may come in from the U. S. free if the British content is kept to the required minimum. This is expected to bring material savings in cost. A reduction in the import tax on gasoline from the United States has been made from 2½ to 1 cent a gallon, and it is thought this will have far-reaching effects on present refinery operations in Canada. A new rate of only 7½ per cent applies to farm machinery, compared with the old 25 per cent rate on the general tariff, later reduced to 15 per cent on intermediate agreements.

April Output

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initial month when the factories were just getting started, the range has been from 304,232 units in February to around 515,000. Even with the most careful planning there was a span of 211,000 units between the high and the low months which indicates the difficulty of forecasting market requirements. The weather extremes of last February, which caused a sharp slump in sales and checked the movement of cars from the factories, upset the calculations somewhat and prevented a more even rate of production which was the goal of every manufacturer.

The industry is now mid-way in the second quarter and sales and production are still going strong. Production so far this month has been maintained at the April rate and indications are that the current month's output will not be much different from that of April. Some let-down in operations is to be expected in June when liquidation of dealers' stocks should be in full swing. But with 1,000,000 units in the bag for the first two months of the quarter, there is little doubt but that the current quarter's output will substantially exceed that of the first three months which totaled 1,127,340 units. It should run from 200,000 to 300,000 units higher.

Domestic retail sales of Buick cars in April totaled 18,761 units compared with 15,107 in March and 6880 in April a year ago. A total of 7352 were delivered in the last 10-day period, exceeding the entire month in 1935.

Chevrolet turned out 143,315 cars and trucks during April. According to officials of the company that monthly figure has been exceeded only four times in its history.

Graham-Paige Motors Corp. revealed this week that April sales were 44 per cent ahead of the corresponding month in 1935 and were the largest of any month in the past year.

Shipments from the Nash factory in April totaled 7012 units which represent a gain of 25.3 per cent over March and 73.2 per cent over April, 1935. This is the largest shipment for any April since 1929.

Topping records for two consecutive months, Oldsmobile sold more cars in April than in any month in the company's history. Total retail deliveries for the month are reported at 24,374 units.

Pontiac retail deliveries in April amounted to 19,512 units and broke all records for the last seven years. Continued buying is expected to set production schedules for May in the vicinity of 22,000 units.

J. L. GREENE has been appointed president and general manager of the Auburn Sales Co. of Chicago. Mr. Greene is a veteran automobile executive and has been in charge of Auburn branches in Indiana for the past six years.

JOHN DOLZA, for the past two years Buick's designing engineer, has been appointed assistant chief engineer of the company. Mr. Dolza's promotion fills the post recently vacated by Charles A. Chayne, who is now chief engineer.

A. W. LELAND has been appointed manager of the Rockford, Ill., works of the J. I. Case Co., Racine, Wis., to fill the vacancy caused by the death of Bradford Brinton.

R. B. WRIGHT has been appointed manager of the Detroit retail branch of the Pontiac Motor Co.

Earnings Statements of Automotive Companies

	1st Quarter 1936	1st Quarter 1935
Hudson Motor Car Co.	$592,827†	$235,610
Mack Trucks, Inc.	107,477	187,018*
Checker Cab Mfg. Corp.	199,224†	92,933*
Briggs Mfg. Co.	2,503,248	3,247,141
Curtiss-Wright Corp.	309,768	197,348*
Hayes Body Corp.	1,160*	49,484*
Kelsey-Hayes Wheel Co.	325,860	430,848
Murray Corp. of America	447,520	527,991
Reynolds Spring Co.	139,806	116,808
Thermoid Co.	45,066	68,135
United-Carr Fastener Corp.	196,518	165,570
Wright Aeronautical Corp.	270,019	69,812
	1935	**1934**
Hupp Motor Car Corp.	2,607,115*	4,398,444*

* Net loss. † Before provision for Federal Tax.

Efficiency in Tools

R. E. W. Harrison Comments on Yardsticks of Value

Obsolescence of the finished product, rather than of the machine which made it, plays the most important part in figuring production costs, according to R. E. W. Harrison of the Chambersburg Engineering Co., and cost analysis set down in dollars and cents on a balance sheet of past performance compared with future expectancy is the starting point of any production plan.

Mr. Harrison, speaking at an informal meeting of the Philadelphia section of the Society of Industrial Engineers on May 6, continued with the idea that if equipment costs can be amortized before the finished product becomes obsolete, then there is little cause for concern about the production machine. Emphasizing the importance of the dollar and cents basis of calculation, the speaker made the statement that in most corporations this is the language that the financial management can understand, rather than a language of efficiency and accuracy, and of speeds and feeds.

Commenting on the importance of modern styling, Mr. Harrison made the statement that there is perhaps as much style consciousness about machine tools as there is in women's hats, and that appearance, even occasionally at the cost of functional efficiency, was known to influence sales.

The advance in modern forging as well as machining operations was illustrated by Mr. Harrison in the fact that it is now possible for a crankshaft to go directly from the forge shop to the grinding machine and there pass through its entire machining cycle in 63 seconds. Many operations, according to this speaker, that are welded in current practice could profitably be produced by forging.

Answering a query from the floor on the attitude of labor toward modern machines, Mr. Harrison drew a striking contrast between two industries. On the one hand, the building trades have made no important changes in production methods, have employed few mechanical aids and have made little change in existing price structures. Today that industry has a million and a half skilled workmen out of jobs. On the other hand, all are familiar with the revolutions that have occurred in automotive production methods and price levels, and today, in this industry there is a definite shortage of labor.

Five Are Wounded in Labor Flare-Up at Goodyear Plant

Five men were shot in Akron, one being wounded seriously, during labor trouble Wednesday night following a sit-down strike of employees in the mechanical goods department at Goodyear. One hundred seventy-five Firestone truck builders sat down at 6 o'clock Wednesday night, charging the company had installed pace setters to speed production. Fourth shift workers at midnight were credited with three hours work and sent home.

National Standard Petroleum Oil Tables, published by the Bureau of Standards, Dept. of Commerce. Known as Circular C410. Date, March 4, 1936. Available from the Superintendent of Documents, Washington, D. C. Price 20 cents.

Automatic temperature control is the theme of an unusually interesting booklet by the Brown Instrument Co., Philadelphia, entitled "Instruments from the Executive Viewpoint." Copies are available through AUTOMOTIVE INDUSTRIES.

Modern developments in **rubber seat-cushions** are graphically portrayed in "Mishawaka Cushions," a profusely illustrated booklet recently published by the Mishawaka Rubber & Woolen Mfg. Co. Copies are available, gratis, through AUTOMOTIVE INDUSTRIES.

Full details of Caterpillar Tractor Co.'s **self propelled road machines** is given in the new catalog **"Caterpillar Auto Patrols."** Two Diesel and two gasoline models are available. This catalog may be procured through AUTOMOTIVE INDUSTRIES.

Complete **plumbing fixtures** for **trailer equipment** are described in current literature of the **Central Brass Mfg. Co.,** Cleveland, Ohio. For further information, address AUTOMOTIVE INDUSTRIES.

DeLong Waukesha President, Fisher Named Vice-President

At the recent meeting of the board of directors of the Waukesha Motor Co., James E. DeLong, vice-president of the company who succeeded H. L. Horning as general manager, was elected president, and James B. Fisher, chief engineer of the company, was elected vice-president. The presidency had been vacant since the death of Mr. Horning on Jan. 4 last. Mr. DeLong's association with the Waukesha Motor Co. dates back 13 years to 1923 when he joined the company as field engineer in the development of the company's products for the oil industry.

Mr. Fisher entered the engineering department as chief of design in 1914, and has been connected with the company since that time. His association with the War Industries Board in the design of the Class B Liberty truck engine brought him distinction.

Olds Workers Ask 20% Wage Increase and 48-Hour Week

The bargaining committee of Oldsmobile workers has sent a resolution to the management and to A. P. Sloan, Jr., president of General Motors, asking a 20 per cent increase in hourly rates and a 48-hour week to be instituted at the beginning of the 1937 production year.

Safety in Middle West

Hoffman and Rodgers Present Motor Vehicle Points at Conference Attracting 3000

Adult safety education, drivers' examinations and the need for compulsion to keep junkers off the streets and highways were the highlights of the automotive sessions of the fourteenth annual Midwest Safety Conference held in Chicago this week. The meetings having to do with automotive affairs attracted by far the lion's share of interest from the 3000 delegates from eight middle-western States.

Speaking for the automobile industry, Paul G. Hoffman, president of Studebaker and chairman of the traffic safety committee of the Automobile Manufacturers' Association, declared that the thing of prime importance today was the education of adult drivers. "Mortality tables for 1935 showed a considerable decline in accidents among drivers of high-school ages," he said, "but, sad to note is the even greater increase in deaths caused by adults.

"I do not believe that the movement that has gained some headway to equip cars with governors limiting speeds to 50 miles an hour is practicable. In the first place, governors are easily tampered with. In the second place, 50 m.p.h. is not the danger mark. Ninety per cent of all fatal accidents occur at speeds less than 50 miles—and fully three-fourths of them occur in the range of between 25 and 35 miles an hour, speeds which everyone considers safe.

"The thing that must be done is stringent education along lines of observance of traffic regulations, and increased care while driving in congested city areas and where there are children."

Speaking for the trucking industry, Ted V. Rodgers, president of the American Trucking Associations, Inc., declared himself as strongly in favor of compulsory physical examinations of all drivers, both trucks and passenger cars. He cited the experiences of commercial fleet operators who have had their men examined.

"Fully 10 per cent of the drivers who have been examined have been found to have defective eyesight. My own experience was no different from anyone else's. Out of about 250 men who make up my payroll, 28 were ordered to get glasses. The average will be found to be even greater with the general run of passenger car drivers, because slow mental reaction, color blindness and other defects will be found."

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

The forward movement of general business continued last week, and one estimate places trade activity at the highest level in the last six years. Retail sales in several lines in April made the best showing this year, while wholesale markets enjoyed a larger volume of business than in any other April since 1931.

Carloadings Higher

Railway freight loadings during the week ended April 25 amounted to 666,181 cars, which marks an increase of 23,524 cars above those during the preceding week, a gain of 107,245 cars above those a year ago, and a rise of 56,477 cars above those two years ago.

Food Costs Unchanged

Retail food costs during the two weeks ended April 7 declined very moderately, according to the Bureau of Labor Statistics. Of the 84 foods included in the index, 36 declined, while 39 rose. The index stood at 78.9 based on the 1923-25 average as 100, as compared with 79.0 a fortnight earlier and 81.2 a year earlier.

Crude Output Above Year Ago

Average daily crude oil production for the week ended April 25 amounted to 2,932,700 bbl., as against 2,935,200 bbl. for the preceding week and 2,561,400 bbl. for a year ago.

Lumber at 64% of 1929

Production of lumber during the week ended April 18 was 64 per cent of the 1929 weekly average. Production and shipments were one and six per cent, respectively, above the figures for the preceding week and were both the highest for any week this year. New business, however, was five per cent below the average for the six weeks preceding.

Electric Output Steady

Production of electricity by the electric light and power industry in the United States during the week ended April 25 was slightly above that in the preceding week and was 15.5 per cent above that in the corresponding period last year.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended May 2 stood at 82.2, as against 82.5 the week before and 82.6 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended April 29 showed no changes in holdings of discounted bills, bills bought in the open market, and government securities. Money in circulation declined $1,000,000, and the monetary gold stock increased $12,000,000.

Douglas Plans New Issue To Finance Huge Backlog

Douglas Aircraft Co. is reported to have in preparation a registration statement for the issuance of rights to stockholders in the ratio of one new for five outstanding shares. Although no price has been set for the additional stock, it is expected to be in the neighborhood of 75 per cent of current market price.

Douglas reports a record high of $19,918,500 in unfilled orders which compares with $4,000,000 on July 10, 1935. Of the current backlog $15,350,000 is in Government orders, $3,461,310 in commercial orders and $1,107,390 in foreign orders. In addition, the Northrop Corp., 51 per cent Douglas-owned, reports a backlog of over $4,000,000.

The first of 20 new Douglas D.S.T. transport planes was delivered to American Airlines, Inc., last Friday. Deliveries of these new 16-24 passenger models are expected at the rate of one a week.

New plant facilities, including what is said to be the world's largest airplane hangar, are under construction at Santa Monica, Calif.

Tire Prices, Wages, Up

(Continued from page 650)

No announcements have been made on the price increases for special de luxe shoes such as Goodyear's Double Eagle and the U. S. Royal Master. What the largest mass distributors will do is the principal concern of the industry at the moment, but current reports at the time this article goes to press are to the effect that they will follow suit.

Caterpillar Board Reelected, Several Executives Promoted

At the annual stockholders' meeting of Caterpillar Tractor Co., recently held at the offices of the company at San Leandro, Calif., the entire board of directors was reelected for the ensuing year. These directors, at their meeting immediately following the stockholders' session, reelected officers of the company, with the following changes:

A. T. Brown, formerly general auditor and assistant secretary of the company, was elected a vice-president; D. G. Sherwin, vice-president, was also named treasurer, succeeding Henry M. Hale, who has been appointed manager of the Eastern sales division; E. R. Galvin, the former Eastern sales manager, was advanced to the post of assistant general sales manager.

Since the appointment of Manuel Rogers as general factory manager and James R. Munro as factory manager of the tractor plant, Benjamin B. Gracier has been promoted to factory manager of the road machinery plant. At the same time, W. E. Bergstrom was advanced to the position of assistant general auditor.

Diesel Fuel Tax Tempts State Revenue Collectors

At a meeting held in Chicago last week, gasoline tax collectors of the nine States comprising the East Central group of the North American Gasoline Tax Conference, considered ways and means for taxing Diesel fuels in portable automotive engines. Matters of refunds, uniform reports and exchange of information, and tax evasion through blending of taxable and non-taxable products were also discussed.

Reports of the meeting indicate that the majority of the States favor a tax on Diesel fuels of greater proportions than that which is levied on gasoline. The States in the East Central group include West Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee, Michigan, Wisconsin and Minnesota.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Invitation to American Inventors

London, April 2, 1896.

Sir: If you have a motor car or motorcycle you should exhibit at the International Horseless Carriage Exhibition at the Imperial Institute, London, which opens May 9.

No charge for space will be made to American exhibitors, and assistance will be given in the cost of freight to inventors requiring such help. . . .

While there are thousands of wealthy persons in this country ready to buy motor vehicles, England has practically not begun to make motor carriages as the law is only now being altered. . . .

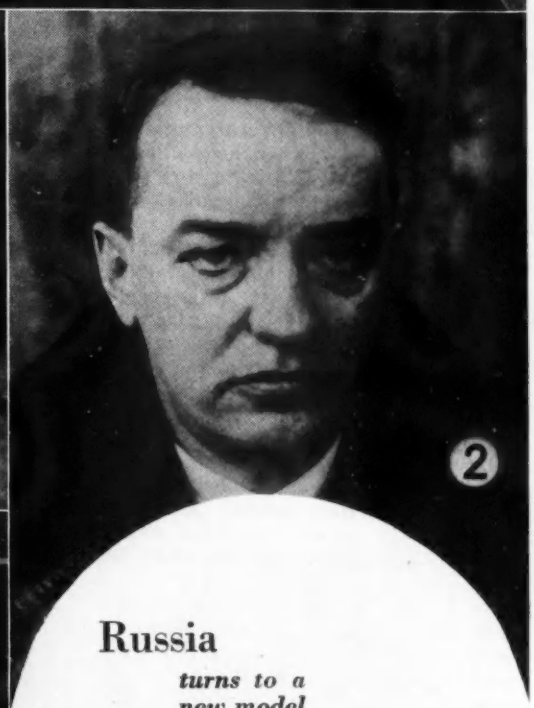
America is greatly in advance in motor cars, and Americans, to share the future trade with this country, should not fail to exhibit their products here. . . .

I am, yours obediently,
C. Harrington Moore,
Hon. Secretary

—From *The Horseless Age*, May, 1896.

The WORLD on WHEELS

1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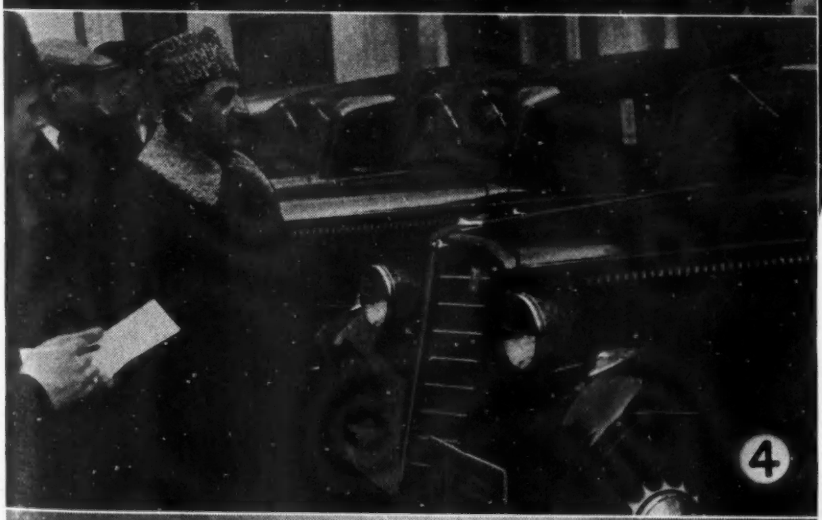
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5

Russia

turns to a new model

1. Engine of the new M-I model ready for the chassis on the assembly line of the U. S. S. R. plant at Gorki.

2. A. A. Lipgart, chief designer of the Molotov automobile works at Gorki.

3. G. K. Parshev (left) head of assembly, inspects work on the line.

4. G. K. Orjonikidze, People's Commissar of Heavy Industry, inspects the first of the new M-I cars to leave the assembly line last March.

5. The first M-I leaves the plant.

Sovfotos

Close Harmony In New Union

(Continued from page 649)

more than a quarter century of labor movement experience behind him. Dillon disliked strikes and favored settlement of differences around the conference table. It was one of the criticisms made of him at the convention that he was not militant enough in strike matters. He delayed the walk-out of his union at the Motor Products plant last fall and a year ago, almost single handed, blocked an attempt to spread the Chevrolet Toledo strike to Flint.

Dillon lost control of the new International, not because he lacked the qualities of leadership, but primarily because he played the game according to the rules. A follower of Green and the old line form of craft union, he met his Waterloo when he declined to grant a single charter to 10 Toledo locals, insisting on individual charters according to approved A.F.L. procedure. It was that issue that definitely spit the U.A.W. into two factions, creating a breach that never healed. There had been division in the ranks ever since Green insisted on naming officers for the new union and retaining provisional control, but it was a smouldering dissension that probably would not have flared up until the next annual meeting. The Toledo charter incident, however, divided the union into two warring camps. A charter was secretly granted by union officials in the opposition. The situation precipitated action by the A.F.L. executive council on the autonomy question and the calling of the convention for election of officers. An active campaign was then launched to oust Dillon. Leaders of the opposition were Homer Martin, general vice-president and Ed. Hall, secretary-treasurer.

Martin Denies Being Radical

Martin, newly elected president of the U.A.W. and leader of the progressive group, is a former Baptist minister of Kansas City who turned automobile worker when his labor union activities lost him his pastorate. An affable young man, he made good his pledge upon taking over the office to "conduct the affairs of the convention in a way to give everyone the right to democratic expression. It isn't a radical clique which has been elected to office," he insists, "but a progressive group. We seek to obtain from the A.F.L. an enlargement of our jurisdictional rights and this is a legitimate fight. We have no desire to hurt the automobile companies, because that is where the automobile worker makes his living, but we believe that the lot of the worker must be improved."

After rejecting a motion to order a general strike at the start of the 1937 model season unless the industry shows "a more favorable attitude toward collective bargaining," the convention voted to favor more militant strike action. Other resolutions were passed upholding industrial unionism and offering support to the National Farmer-Labor party. Preceded by considerable controversy and a two-to-one rejection on the first vote, a resolution was finally adopted unanimously, as a matter of expediency, endorsing President Roosevelt for relection. Delegates went on record against Communism, Fascism and other "isms."

A five-point program was adopted through which the union will seek a 30-hour week, oppose piece work in automobile plants, provide seniority rights, increase wages and make possible real collective bargaining.

A considerable amount of unfinished business remained when the conven-

Best First Quarter Since '29

Car Registrations Gained 22% Over Last Year; General Motors Cars 44% of Total

New Passenger Car Registrations*

	March 1936	February 1936	March 1935	Three Months 1936	Three Months 1935	Per Cent Change, 3 Mos. 1936 over 1935	Numerical Change, 3 Mos. 1936 over 1935	Per Cent of Total Three Months 1936	Per Cent of Total Three Months 1935
Chevrolet	86,504	53,056	55,067	202,830	111,152	+ 82.7	91,678	29.43	19.67
Ford	68,428	43,483	93,864	162,896	205,127	— 20.6	—42,231	23.64	36.29
Plymouth	40,494	23,388	34,162	93,993	85,921	+ 9.4	8,072	13.64	15.20
Dodge	20,853	11,031	17,246	47,198	37,576	+ 25.6	9,622	6.85	6.65
Oldsmobile	17,328	9,299	14,535	38,243	28,208	+ 35.5	10,035	5.55	4.99
Pontiac	14,235	7,781	13,231	31,460	27,832	+ 13.1	3,628	4.56	4.92
Buick	12,814	6,593	5,266	28,634	13,157	+118.0	15,477	4.15	2.33
Terraplane	6,255	3,704	4,514	14,643	10,793	+ 36.0	3,850	2.12	1.91
Studebaker	5,608	3,168	3,234	12,750	8,034	+ 59.0	4,716	1.85	1.42
Chrysler	4,946	2,763	4,224	11,397	8,794	+ 29.8	2,603	1.65	1.56
Packard	4,604	2,396	907	10,058	1,686	+494.0	8,372	1.50	.31
De Soto	3,202	1,748	2,531	7,290	5,250	+ 39.0	2,040	1.06	.93
Hudson	1,877	1,223	1,810	4,865	4,391	+ 10.7	474	.71	.78
Nash	1,909	956	1,184	4,346	2,820	+ 54.0	1,526	.63	.50
La Fayette	1,652	863	1,197	3,649	2,858	+ 27.9	791	.53	.51
Graham	1,264	790	1,278	2,954	2,774	+ 6.5	180	.43	.49
Lincoln	1,010	697	135	2,510	363	+856.0	2,147	.36	.06
Cadillac	985	627	421	2,478	1,034	+139.5	1,444	.35	.18
La Salle	1,013	564	492	2,295	1,265	+ 81.3	1,030	.33	.22
Willys	793	781	973	2,281	1,877	+ 21.7	404	.32	.33
Hupmobile	284	202	762	820	1,754	— 53.3	—934	.12	.31
Reo	315	155	310	713	732	— 2.6	—19	.10	.13
Auburn	180	172	466	556	1,375	— 59.5	—819	.08	.24
Pierce-Arrow	72	48	57	176	146	+ 20.6	30	.03	.03
Cord	81	7	.....	88	.....	.....	88	.01	.....
Miscellaneous	16	22	55	49	252	— 80.6	—203	.....	.04
Total	296,722	175,517	257,921	689,172	565,171	+ 22.0	124,001	100.00	100.00
Chrysler Corp.	97,429	38,930	58,163	159,878	137,541	+ 16.2	22,337	23.20	24.34
Ford and Lincoln	41,504	44,180	93,999	165,406	205,490	— 19.4	—40,084	24.00	36.35
General Motors	132,879	77,920	89,012	305,940	182,648	+ 67.6	123,292	44.39	32.32
All Others	24,910	14,487	16,747	57,948	39,492	+ 46.7	18,456	8.41	6.99

New Truck Registrations*

	March 1936	February 1936	March 1935	Three Months 1936	Three Months 1935	Per Cent Change, 3 Mos. 1936 over 1935	Numerical Change, 3 Mos. 1936 over 1935	Per Cent of Total Three Months 1936	Per Cent of Total Three Months 1935
Chevrolet	19,332	14,878	13,607	49,434	35,175	+ 40.5	14,259	36.38	31.82
Ford	15,969	12,133	16,603	42,801	44,193	— 3.1	—1,392	31.50	39.98
Dodge	6,669	5,524	4,216	18,432	12,628	+ 46.0	5,804	13.57	11.42
International	5,314	4,324	3,620	14,422	10,307	+ 40.0	4,115	10.61	9.32
G. M. C.	1,533	750	827	2,719	2,255	+ 20.6	464	2.00	2.04
Diamond T	627	506	528	1,632	1,577	+ 3.6	55	1.20	1.43
White	348	291	238	1,050	723	+ 45.3	327	.77	.65
Reo	256	214	377	812	1,049	— 22.5	—237	.60	.95
Plymouth	231	185	8	612	16	.....	596	.45	.01
Federal	199	161	130	592	395	+ 50.0	197	.44	.36
Studebaker	221	134	135	498	369	+ 35.0	129	.37	.33
Willys-Overland	142	141	136	462	214	+116.0	248	.34	.19
Mack	177	107	97	374	274	+ 36.6	100	.28	.25
Indiana	118	115	14	317	54	.....	263	.23	.05
Brockway	121	88	66	303	206	+ 47.0	97	.22	.19
Terraplane	139	93	34	292	78	+274.0	214	.21	.07
Stewart	73	62	60	220	136	+ 62.0	84	.16	.12
Autocar	87	54	55	219	167	+ 31.1	52	.16	.15
Divco	61	33	12	147	44	+234.0	103	.11	.04
F. W. D.	48	37	15	104	60	+ 73.4	44	.08	.05
Twin Coach	8	38	2	47	17	+176.5	30	.03	.02
Sterling	17	4	14	29	34	— 14.7	—5	.02	.03
Miscellaneous	127	129	200	360	579	— 37.7	—219	.27	.53
Total	51,817	40,001	40,994	135,878	110,550	+ 22.9	25,328	100.00	100.00

*All data complete with exceptions of returns from Connecticut.

tion came to a close on Saturday. Business pertaining to the constitution, by-laws and resolutions was turned over to the newly-elected executive council, meeting in Detroit this week, and details not worked out at the convention will be decided upon and submitted to the various locals for approval.

Intensive Membership Campaign Planned

One of the first items of business before the council will be a plan for a membership campaign throughout the industry with the assistance of organizers from the United Mine Workers and other unions in the Committee for Industrial Organization. Terms also will be determined upon under which independent unions may come into the International Union. On recommendation of its organization committee, the convention approved a program that called for raising of a $250,000 organization drive fund. Contributions totaling $75,000 would be sought from the various locals, while outside groups, including the A.F.L. and its C.I.O., would be asked to subscribe the balance.

A big stride toward its membership goal would be made if the International succeeds in its aim to absorb the three leading independent unions whose combined strength parallels, if not exceeds, the U.A.W.'s 40,000 members. Largest of the independents is the Automotive Industrial Workers Association, with claimed membership of 26,000 workers, followed by the Mechanics Educational Society with 11,000 and the Associated Automobile Workers of America with an estimated 5000 members, exclusive of its affiliated organization of garage workers in Massachusetts.

It is highly probable that the A.I.W.A. and the A.A.W.A. will come under the International's banner in the near future. At least these are the most promising prospects. The M.E.S.A. is understood to be afflicted with factional troubles and so long as its present leadership is in control, is not regarded as a likely prospect for consolidation. The M.E.S.A., moreover, with its large percentage of tool and die workers, involves the disputed jurisdictional question.

All three unions had observers at the South Bend convention. While not authorized to speak for their organizations, the representatives indicated they were favorably impressed. Richard Frankenstein of the A.I.W.A. announced to delegates he would recommend that his organization join the International. Arthur E. Greer, president of the Hudson local of the Associated, told the convention that he felt "the time for unity in the automobile labor movement is at hand." John Anderson, representing the Detroit district council of the M.E.S.A. promised to take proposals for amalgamation back to his union, but Mathew Smith, secretary of the Mechanics, said Anderson was not authorized to speak for the M.E.S.A., that "no offer has been made and we are not anxiously awaiting one."

While definite terms for amalgamation have not been submitted to the independents, they have been given to understand that they will be permitted to come in as a group and to retain their autonomy. As an incentive, the convention voted unanimously to provide an additional seat on the executive board to accommodate a representative of the independents if and when they affiliate with the International. Further impetus to the merger movement was given by Father Coughlin who, union officials said, happened to be in South Bend on Thursday of convention week and was prevailed upon to speak at the banquet that night.

Coughlin Sees "Smash" in Two Years

Coughlin, a special friend of the Automotive Industrial Workers Association, told the delegates, "a vertical or industrial union is the only answer for your industry. Away with the independent organization. Dare your bosses to fire you," he said. "If you aren't kicked out now for your courage you will be kicked out in a couple of years when the country goes to smash."

The convention authorized the sending of four delegates to the next annual convention of the A.F.L. at Tampa, designating the president, first and second vice-presidents and one executive board member as delegates who will appeal for broader jurisdictional powers.

Members of the new general executive board are: J. J. Kennedy, Lloyd Jones and Walter Reuther, all of Detroit; Lester Washburn of Lansing; Russell J. Merrill, South Bend; Willis A. Marrer, Norwood; John Soltis, Cleveland; F. J. Michael, Racine; Frank P. Tucci, Tarrytown; Delmond Garst, St. Louis, and Fred C. Pieper, Atlanta.

Salaries of officers of the International were adjusted in a resolution fixing $3,000 annually as salaries of the president, three vice-presidents and general secretary-treasurer. The constitution previously provided that the president receive $6,500, the single vice-president, $4,500 and the secretary-treasurer, $4,500.

It was voted to continue the International office of the U.A.W. in Detroit.

New Earnings Records

(Continued from page 649)

Mack Trucks, Inc., announce net profit for the first three months of $104,477 after all charges including taxes. This is equivalent to 18 cents a share on 597,335 shares of no par common stock outstanding. Net loss for same period last year $187,018.

The General Motors Corp. this week declared an extra dividend of 75 cents a share in addition to the regular quarterly dividend of 50 cents. The extra distribution will amount to $54,375,000 and is interesting in comparison with the recently announced net earnings for the first quarter of $52,464,174.

International News photo

Harvard University's scientific test for drivers opened this week at the New York Museum of Science and Industry. Watching Ab Jenkins, holder of several automobile world speed records, test his reactions, are: (left to right) Alfred Reeves, of the A.M.A.; Dr. Miller McClintock, director of Harvard's Bureau of Street Traffic Research; Leo J. Eastman, vice-president of Packard; Harold Fowler, deputy police commissioner of New York City; and Harry R. De Silva, in charge of the exhibit.

Automotive Exports Continue Gains

Total Value Rose Nine Per Cent for First Quarter; Overseas Truck Shipments Show One-Third Increase

Exports and Imports of the Automotive Industry for March and Three Months Ended March, 1936-1935

EXPORTS	March				Three Months Ended March			
	1936		1935		1936		1935	
	Number	Value	Number	Value	Number	Value	Number	Value
Motor Vehicles, parts and accessories	....	$23,954,988	....	$25,018,471	....	$68,180,704	....	$62,749,099
PASSENGER CARS								
Passenger cars and chassis	18,792	11,204,998	20,986	11,105,171	50,515	29,371,860	47,088	26,435,968
Low price range $850 inclusive	16,994	9,254,360	19,910	9,904,296	46,089	24,491,819	43,599	22,524,619
Medium price range over $850 to $1,200	1,554	1,495,025	792	759,620	3,720	3,573,866	2,556	2,451,797
$1,200 to $2,000	172	257,291	138	211,029	469	686,403	410	640,179
Over $2,000	72	198,322	70	35,351	237	619,772	249	100,335
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	9,972	4,926,133	8,820	4,550,357	29,625	14,707,791	22,176	11,608,589
Under one ton	1,282	494,179	640	220,095	4,194	1,523,175	1,745	600,048
One and up to 1½ tons	6,037	2,721,877	6,811	2,999,066	19,399	8,829,963	16,685	7,412,388
Over 1½ tons to 2½ tons	1,527	1,047,967	1,094	899,622	3,923	2,772,242	3,092	2,430,679
Over 2½ tons	326	373,901	234	388,635	913	1,129,290	551	1,094,456
PARTS, ETC.								
Parts except engines and tires	....	.....	....	.....	....	.....	....	.....
Automobile unit assemblies	....	4,213,294	....	6,105,861	....	13,745,098	....	16,019,148
Automobile parts for replacement (n.e.s.)	....	2,118,433	....	2,306,604	....	6,029,425	....	6,060,109
Automobile accessories (n.e.s.)	....	232,514	....	279,826	....	846,540	....	759,355
Automobile service appliances	....	296,150	....	446,753	....	1,059,481	....	934,101
Airplanes, seaplanes and other aircraft	24	393,048	51	1,104,460	81	1,435,692	97	2,782,593
Parts of airplanes, except engines and tires	....	273,501	....	482,620	....	951,512	....	1,124,852
INTERNAL COMBUSTION ENGINES Stationary & Portable								
Diesel and semi-Diesel	38	154,169	20	28,243	109	454,737	42	70,915
Other stationary and portable	....	.....	....	.....	....	.....	....	.....
Not over 10 hp.	1,235	85,333	610	44,521	2,724	192,249	2,165	120,729
Over 10 hp.	425	117,649	147	66,734	874	277,215	335	209,189
Automobile engines for:								
Motor trucks and buses	2,984	298,317	246	45,986	8,935	855,423	632	103,907
Passenger cars	6,206	466,266	2,852	177,767	16,969	1,233,836	7,622	494,097
Engines and aircraft	93	553,072	54	131,501	176	893,610	108	321,980
Accessories and parts (carburetors)	....	163,272	....	135,602	....	472,745	....	372,375
IMPORTS								
Automobile and chassis (dutiable)	40	15,448	32	9,198	149	62,473	105	61,485

Automotive Metal Markets

Steel Mills Count on High Operating Rate During Month as Motor Schedules Hold Up

Nearby production schedules of automobile plants are looked upon in the steel market as assurance that a fairly high operating rate can be maintained in May by rolling and finishing mills. Steel market statisticians point out that output of automotive units still runs considerably below that of the spring of 1929, but overlook the greater amount of steel used in 1936 models, compared with those of 1929.

Shipments into automotive consumption continue heavy, with more and more of the billing on a full-price basis. Bolt and nut shipments are reported to be running 10 to 15 per cent ahead of the corresponding week of last month. Parts makers are placing good-sized order for hot and cold rolled strip, and mills are favored by an increase in round lot business, due to buyers wanting to get the full benefit of quantity differentials. This is also noticed in the placing of business by forging plants. Demand for merchant and cold-finished steel bars is well maintained.

From the insistence of most consumers upon shipment within a week or so, following the receipt by mills of specifications, it is concluded that buyers are not ordering a pound of steel until they need it and that they have no reserve stocks. This conservative attitude on the part of buyers is, to some extent at least, reflected in the policy of the smaller finishing mills in getting every possible ton of production out of the equipment they have in operation, rather than to put additional mills into operating condition.

Continuous sheet and strip mills operate at a relatively high rate, but the conventional method for estimating the percentage of capacity at which the flat rolled steel industry is operating furnishes little indication of what these ultra-modern units might be capable of producing, were there so sharp an increase in the demand as to make stepping up of normal steel mill working periods or turns expedient. The price situation is unchanged.

Pig Iron—Middle West markets report better shipping releases as well as some fresh buying by automotive foundries. Prices are holding steady all along the line.

Aluminum—Conditions in the market for primary metal are unchanged. The secondary market shows a slightly easier undertone, scrap supplies being larger, with some of the remelters rather offish. Quotably there is no change in prices.

Copper—The market continues to be a dull affair, consumers being so well covered that they take little interest in offerings. Effective at the beginning of this week, prices of copper, brass and bronze sheets were raised ¼ cent per lb. Brass rolling mills explained that this was necessary to bring prices for their finished products into line with 9½-cent copper.

Tin—While on the London Metal Exchange a decline in tin prices was noted on Monday, a rise in Sterling exchange largely offset this, spot Straits tin being quoted at the beginning of the week at 46⅞ cents, ⅛ cent lower than at the preceding week's close.

Lead—Quiet and firm.

Zinc—Steady and unchanged.

Building of GM's New Plant At Mexico City Under Way

The corner stone of General Motors of Mexico's assembly plant at Mexico City was laid by Mayor Cosme Hinojosa recently, representing President Lazaro Cardenas. The construction contract calls for the plant, which is to have a floor space of 12,000 square meters, in grounds 48,000 meters square, to be ready for service by Sept. 1. Building costs will be 1,220,000 pesos (about $286,000, U. S.). The initial production is to be 60,000 units a year.

Trucks only will be assembled at first, but the program calls for adding other items of the GM line.

Copyright by Bachrach

Albert A. Reiter

Office manager of the Autocar Co., has just completed 25 years of service with his company. He began as clerk in the payroll department and rose through the accounting department to his present position.

Steel Institute to Meet In New York on May 28

Program of the 45th general meeting of the American Iron and Steel Institute, to be held Thursday, May 28, at the Waldorf-Astoria Hotel in New York, includes addresses by several of the leading executives of the steel industry, a session devoted to the presentation of technical papers, and a banquet in the evening.

E. G. Grace, president of Bethlehem Steel Corp., will address the morning session in his capacity as president of the Institute. Other talks will be made by: W. A. Irvin, president of United States Steel Corp., and vice-president of the Institute; T. M. Girdler, chairman of Republic Steel Corp. and vice-president of the Institute; E. T. Weir, chairman of National Steel Corp.; and Charles R. Hook, president of the American Rolling Mill Co.

A report on Institute activities will be presented by W. S. Tower, executive secretary of the Institute. The afternoon session will be featured by a review of metallurgical progress by Dr. Albert Sauveur, who is the Gordon McKay professor of metallurgy at Harvard University. The program for the afternoon session will also include three other papers on metallurgical topics: "Electric Furnaces and Their Part in Metallurgical Progress," by Frank R. Palmer, assistant to the president, The Carpenter Steel Co.; L. F. Reinartz, works manager, Middletown division, the American Rolling Mill Co., will read a paper on "Recent Advances in Open Hearth Furnace Design and Operation," and Clyde E. Williams, director of Battelle Memorial Institute, will read a paper entitled, "The New Technical and Economic Importance of Iron and Steel Scrap."

Light 6-Cyl. Engine Wins Outboard Record

In taking the world's outboard record away from the American, J. B. Coleman, with an average speed of 74.39 miles for the measured mile, Jean Dupuy made use of a six-cylinder engine of 1000 cc. (61 cu. in.). The cylinders are two opposed sets of three, in light alloy, each set having a detachable head with two overhead camshafts. The crankshaft is vertical, and the train of gears operating the camshafts is in the lower portion of each cylinder casting. The motor is supercharged and is claimed to develop 105 hp. at 6000 r.p.m. At this engine speed the propeller turns over at 10,000 r.p.m. Weight of the motor is 230 lb.

March Retail Financing Up

The dollar volume of retail financing of new passenger cars for the month of March showed an increase of 62 per cent over February, and 50 per cent over March, 1935, according to preliminary estimates released by the Bureau of Foreign and Domestic Commerce.

In France, Too, Railroads Fight Truck Transportation

Last week the first trucks appeared in Paris bearing the official sign, "Paris" or "Paris and Seine," indicating that, in accordance with recent decrees, they are not allowed to operate outside the areas indicated. This is one of the measures taken by the Government, at the instigation of the railways, to bridle truck competition. Some of the areas to which trucks are restricted do not exceed 20 square miles. Before they can pass out of this district they must obtain a special permit and pay a special tax.

Having obtained this measure against trucks, there is a fear that the railway companies will attempt to place similar restrictions on private cars. Already they are offering to carry cars much below cost when travelers make use of the train.

Autocar Plan Approved

At an adjourned meeting in Ardmore this week, stockholders of the Autocar Co. approved the revised refinancing plan recently submitted by mail, according to a statement of the company. It was also announced that the issue of new debentures amounting to $310,000 has been purchased by the Phoenix Securities Corp. A description of the new plan appeared in AUTOMOTIVE INDUSTRIES April 25.

Calendar of Coming Events

SHOWS

Spain Automobile Show, Madrid, May 10-20
International Aero Exhibition, Stockholm, Sweden .....May 15-June 1
International Petroleum Exposition, Tulsa, Okla. .....May 16-23
Morocco, Fair of Tangiers.....May 16-24
Yugoslavia 16th International Spring Fair, Lubliana .....May 30-June 11
France, Automobile Exhibit at Foire de Paris .....May
Norway, Automobile Show, Oslo.....May
Olympia Motor Show, London, England, Oct. 15-24
National Motor Truck Show (N. J. Motor Truck Assn.), Newark, N. J., Nov. 3-7
National Automobile Show, Grand Central Palace, New York.....Nov. 11-18
International Aviation Show, Paris, France .....Nov. 13-29
Boston Automobile Show.....Nov. 14-21
Columbus Automobile Show ....Nov. 14-20
Chicago Automobile Show.....Nov. 14-21
Detroit Automobile Show.....Nov. 14-21
Washington, D. C., Automobile Show, Nov. 14-21
Cincinnati Automobile Show....Nov. 15-21
St. Louis Automobile Show.....Nov. 15-22
Baltimore Automobile Show....Nov. 21-28
Brooklyn Automobile Show.....Nov. 21-28*
Cleveland Automobile Show.....Nov. 21-28
Kansas City Automobile Show..Nov. 21-29*
Milwaukee Automobile Show....Nov. 22-29
Peoria Automobile Show...Nov. 30-Dec. 5*
Philadelphia Automobile Show, Nov. 30-Dec. 5*
Natl. Exposition of Power & Mechanical Engineering, Biennial Meeting, New York City .....Nov. 30-Dec. 5
International Commercial Motor Transport Exhibition, London, England, November

* Tentative dates.

CONTESTS

500-Mile International Sweepstakes, Indianapolis .....May 30

CONVENTIONS AND MEETINGS

Second Dearborn Conference of Agriculture, Industry and Science, May 12-14
American Petroleum Institute Mid-Year Meeting, Tulsa, Okla..May 13-15
National Battery Manufacturers Association, Spring Convention, Cleveland .....May 20-21
American Iron and Steel Institute, 45th General Meeting, Waldorf-Astoria Hotel, New York .....May 28
S.A.E. Summer Meeting, White Sulphur Springs, W. Va.....May 31-June 6
Automotive Engine Rebuilders Assoc. Annual Convention, Cincinnati, June 1-4
National Association of Credit Men, 41st Annual Convention, Richmond, Va. June 8-12
American Society for Testing Materials, Annual Meeting, Atlantic City .....June 29-July 3
National Association Power Engineers, Annual Meeting, Chicago, Aug. 31-Sept. 4
American Transit Association, Convention, White Sulphur Springs, W. Va. .....Sept. 21-24
American Society for Metals, 18th Nat'l Congress, Cleveland, O. ....Oct. 19-23
American Gas Association, Annual Meeting, Atlantic City.....Oct. 26-31
American Petroleum Institute, Annual Meeting, Chicago .....Nov. 9-12
Natl. Industrial Traffic League, Annual Meeting, New York City.....Nov. 19-20

The Stroboscope At Work in

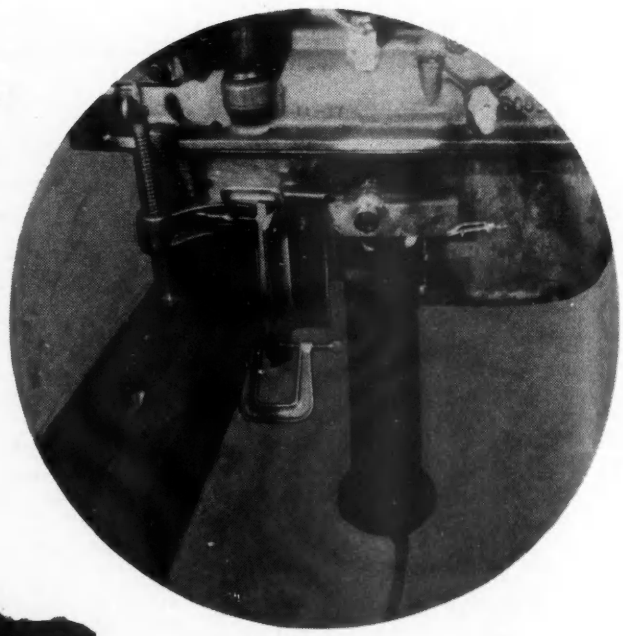
THE stroboscope (from the Greek *strobos*, whirl, and *skopos*, watcher) is an instrument for studying an object in rapid periodic motion by exposing it to view for repeated short time intervals, always at the same phase of its cycle of motion. With its aid the moving object can be made to appear stationary, by making the period of the observations exactly equal to the period of the motion to be studied; or it can be made to appear to move slowly, either in the actual direction or in the reverse direction, by making the period of observations slightly longer or shorter than that of the motion to be studied.

While the stroboscopic method was first used—and is still being used in the great majority of cases—for the study of periodic motions, its application is by no means restricted to visual phenomena. It is applicable to the study of all kinds of rapidly changing periodic phenomena, such as pressures (point-by-point pressure indicators), temperatures (thermo couples connected to phasing contacts), noises in high-speed engines (the Strobophonometer of Carpenter and Stansfield), chemical changes such as the propagation of flame and scavenging in engine cylinders (various types of sampling valves), and changes of electrical quantities such as voltages and currents in alternating current circuits (Joubert's contact disc). Therefore, a more general definition is as follows: Stroboscopy is a method of studying a (rapidly changing) periodic phenomenon by means of periodically recurring observations, each lasting a small fraction of the period of the phenomenon to be investigated.

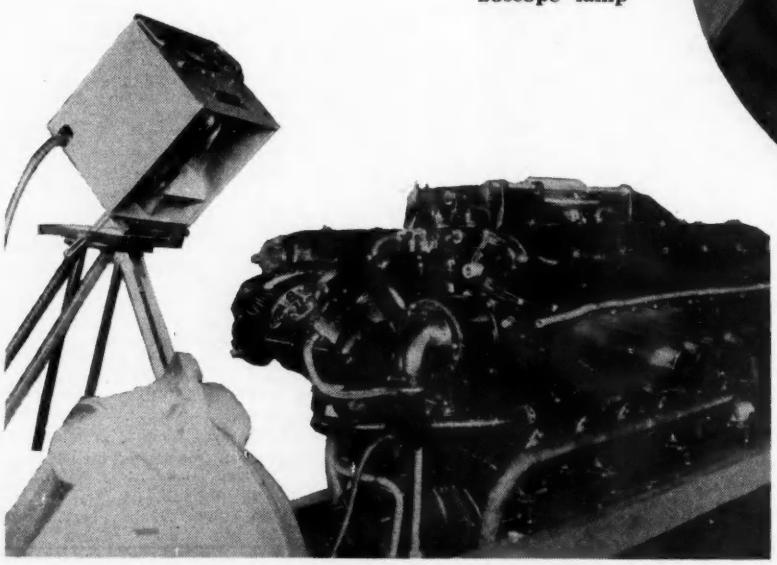
In order to be stroboscopically observable, both the phenomenon and the method of observation must fullfill certain conditions:

First, the phenomenon must be a truly periodic function of some independent variable, such as time, crank angle, distance traveled, etc.; that is, it must assume the same value at the recurrent phases of the argument.

Second, the means of observation must be capable of being actuated by, or adjustable to, the same independent variable.

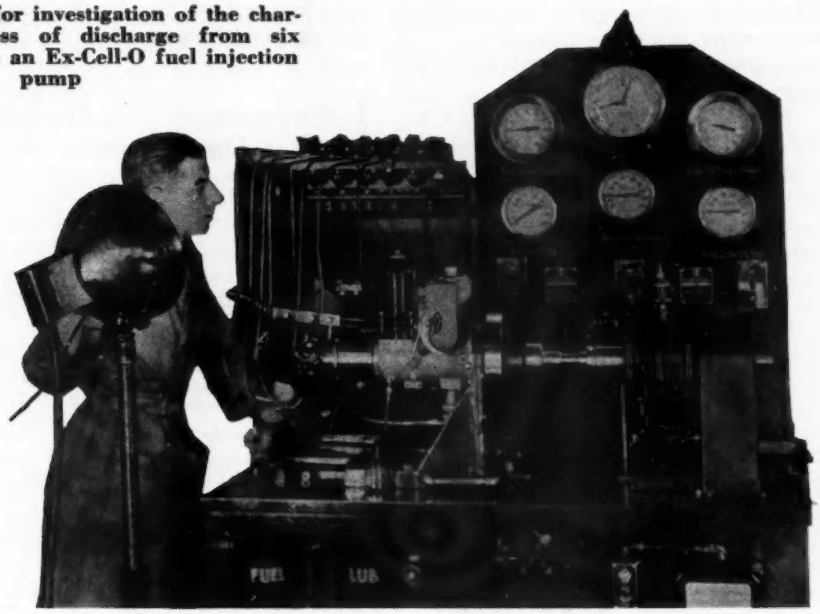


Measuring crankshaft deflection on a Plymouth engine. The light from the Edgerton Stroboscope is passed through a glass window in the crankcase and the crankshaft is observed through the microscope shown immediately above the Stroboscope lamp



Left — Westinghouse "Stroboglow" used for observing the action of the ignition interrupter on an airplane engine

Stroboscope used for investigation of the character and evenness of discharge from six nozzles attached to an Ex-Cell-O fuel injection pump



Part 1

By K. J. DeJuhasz* and Norman Young, Jr.**

Automotive Research

In the present article only visual stroboscopes will be dealt with.

The Visual Stroboscope

When using a visual stroboscope, the eye receives repeated, intermittent images of the moving object. Owing to the phenomenon of the "persistence of vision," the retina of the eye retains the impression of an image for a certain length of time (1/10 to 1/5 second) after the stimulus has ceased. By virtue of this characteristic of the human eye, the consecutive intermittent images blend into one, provided successive images follow one another with sufficient rapidity. With four or five images per second, observation becomes possible, but flickering is present; with ten images per second there is practically no flickering, and with 20 per second it becomes unnoticeable and the image appears perfectly steady.

The physiological concepts and principles entering into stroboscopic observations can be summarized as follows:

A light stimulus of certain intensity acting on the retina does not produce its full effect instantaneously, but only after a certain lapse of time, called the "action time" of the light stimulus. The action time depends on the color of the light, and even more on its intensity, varying from 0.2 sec. with weak stimuli to 0.03 sec. with strong stimuli.

The shortest time interval which permits of distinguishing between two sight sensations, when the two stimuli act on the same spot of the retina, is 0.04 to 0.05 sec. In ordinary daylight, a rotating disc with a surface that is part white and part black, appears to be gray, as the sensations blend when the alterations come at the rate of more than 20 or 25 per second. If the time interval between successive sight sensations is less than this, the consecutive sight sensations blend into one continuous sensation.

When brief stimuli are employed, the resulting brilliance depends on the product of the intensity and the duration of the stimulus. This is expressed by Talbot's principle, which may be stated as follows: If any part of the retina is periodically excited with a light of given intensity for a certain time a, and then left unexcited for a time b, the time $a + b$ being less than the action time, then the sensation becomes continuous for a strength corresponding to the excitation $a/(a + b)$ times the given in-

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This is the first of two articles in which the authors fully describe the operation of different types of stroboscopes and their application to automotive research. Part 2 will appear in an early issue.

tensity; in other words, the brilliance represents the time integral of the photometric intensity divided by the time.*

Besides steadiness, two other characteristics of stroboscopic impressions are important, viz., sharpness of definition and brightness.

The sharpness of definition is dependent on the displacement of the object during the time of its exposure. This time element being a brief but finite quantity, there will be a certain blurring of the impression received by the eye, which is directly proportional to the duration of exposure and to the speed of the object at the phase of observation.

The brightness of the image is proportional to the intensity of illumination of the object, and to the percentage of exposure time to total time.

Sharpness and brightness are, therefore, conflicting requirements, the former requiring a short, the latter a long exposure. To satisfy both requirements it is necessary to provide as intense an illumination as other considerations allow.

On the basis of the means used for viewing the object, visual stroboscopes fall into two main groups:

1. Uninterrupted illumination, interrupted line of vision;

2. Interrupted illumination, uninterrupted line of vision.

*For additional information on this subject see Ladd and Woodworth, Elements of Physiological Psychology, Charles Scribner's Sons, 1911, pp. 474-478, and Troland, The Principles of Psychophysiology, Vol. II, pp. 88 ff., D. Van Nostrand Co., New York, 1930.

I. Stroboscopes with Interrupted Line of Vision

In this group belong the simplest stroboscopes, originated by Plateau in France and Stampfer in Germany about 1832. These experimenters used a disc or cylinder provided with a series of slits through which the observer looked at pictures (pasted on the inside of the cylinder, or on another coaxial disc) of a moving object such as a jumping horse or a running man, represented in successive stages of its action. As the disc or cylinder rotates, these slits come successively before the eye, and through them the observer gets a series of glimpses of the moving object. An illusion of motion is produced, provided that the interval between the glimpses of the pictures is less than the duration of image-retention on the retina.

Apart from such amusement devices, the stroboscope was used by Plateau also for the scientific investigation of a vibrating tuning fork, for which purpose he used a rotating disc having a number of slits near its periphery. In modern forms such a simple stroboscope is usually constructed with only one narrow slit or window, and it is driven at an adjustable speed by either clockwork or an electric motor.

The advantages of this type of stroboscope reside in its simple design and operation. The object can be viewed in daylight or in a bright artificial light. For sharpness of definition the angle included by the slit or window must be small, and this calls for a large disc, which is cumbersome to set up, operate and move about when the observer wants to shift his position relative to the object to be studied. A stroboscope of this kind was used by the Junkers Engine Laboratory for the observation of flame phenomena in the combustion chamber of an internal combustion engine (Ref. 5).

A refined form of this apparatus is the compound stroboscope in which two coaxial discs are arranged close to each other, each having a window near its periphery, permitting vision when the two windows register with each other. One of the discs is rotated at a speed corresponding to the frequency of the motion to be studied and the other at a multiple of that speed (say ten times as fast). This refinement allows a considerable reduction of the dimensions and renders the apparatus more readily portable. One such apparatus has been built at the Bureau of Standards and was used by Marvin and Best in an investigation of flame propagation inside the cylinder of a high-speed internal combustion engine (Fig. 1, Ref. 6).

A further improvement is represented by the Ashdown Rotoscope, (Fig. 2, Ref. 7) which, besides effecting a reduction in dimensions, also permits binocular vision, instead of the single-eyed observation used with previously described stroboscopes. In this apparatus, instead of a disc, a cylinder is used, with two openings in it for the two eyes of the observer. Each opening is provided with thin opaque blades parallel with the cylinder axis and with each other, which blades subdivide the field of vision. By this means a rapid shutter effect is obtained, together with a large aperture for vision. The sharpness of definition can be increased by increasing the number of the opaque blades, at the cost of the brightness to be sure, on account of the thickness of the blades and the reduced duration of exposure.

Another method of increasing the sharpness is by use of the "heteroptic" principle. In this modification of the instrument, a coaxial outer sleeve surrounds the internal shutter. One of the shutters (usually the inner) rotates at the frequency of the object to be investigated, while the other (the outer sleeve) rotates at a speed which is a multiple thereof. In the case of the Ashdown Rotoscope the speed of the sleeve is nine times that of the shutter. On account of the great speed of the outer sleeve, and also because of the

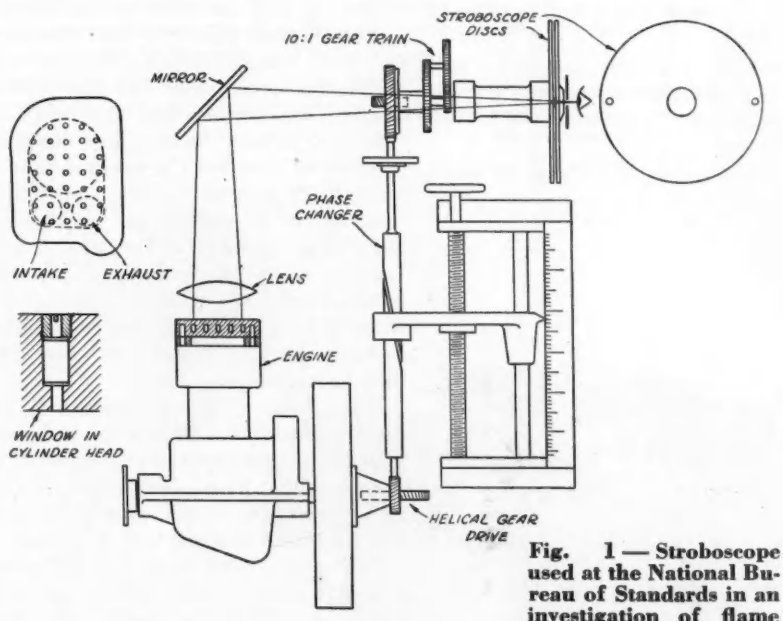


Fig. 1 — Stroboscope used at the National Bureau of Standards in an investigation of flame phenomena in internal combustion engines (Marvin and Best)

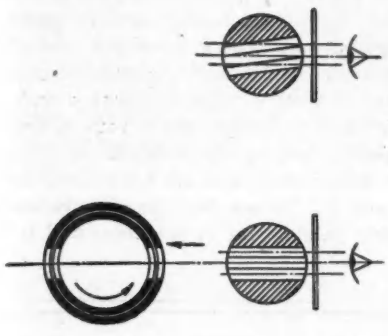


Fig. 2—Principle of the Ashdown Rotoscope. a, normal bladed shutter; b, heteroptic shutter

great reduction in brightness due to the reduction of the duration of illumination, this type of instrument is not adaptable to such high-speed investigations as the simple, bladed type, but where it is applicable it is superior to the latter.

A further modification incorporated in the Ashdown instrument consists in the displacement of the two apertures by 90 deg., whereby the observer views the phenomenon with his two eyes alternately instead of simultaneously. This results in a greater steadiness and sharpness of the image. Four glimpses of the rotor are obtained per revolution, instead of two as in the case of the normal instrument, hence, the rotor must be driven at one-fourth the speed of the object to be investigated. This type of instrument, therefore, is suited for the study of extremely high frequencies.

The rotor of the Ashdown instrument is mounted in jewel bearings and is dynamically balanced; it is easily handled, owing to its small dimensions, the rotor being 4¼ in. long and of 1 in. diameter. The drive is by spring motor (clockwork) and a speed-change gear. The speed of the shutter is finely adjustable by a sensitive centrifugal governor. For any setting of the governor the speed of the rotor spindle is indicated on a dial. Therefore, the speed of the motion to be studied can be determined without any mechanical connection with the observed object. The range of the normal type instrument is stated by the manufacturers to be from 500 to 20,000 r.p.m.; with the heteroptic shutter, from 200 to 1800 r.p.m., and with the displaced shutter up to 40,000 r.p.m. At present this instrument is being manufactured also with electrical drive from a 12-volt battery, whereby its bulk and weight are still further reduced (Ref. 7).

Another binocular stroboscope, the "Whidbourne," incorporates a drum having a pair of slots along a chord (not along a diameter) through which the object is viewed (Fig. 3, Ref. 8). By virtue of this arrangement, only one glimpse per revolution is obtained. An ingenious arrangement allows a second series of slots to become operative, by which ten glimpses are obtained per revolution of the rotor. This latter is used for the study of extremely high frequencies. As the will of the operator, either the single-glimpse slot or the ten-glimpse set of slots can be moved into the line of vision by means of a small reflecting mirror. The drum of 2¼-in. diameter by 4-in. length is driven by a small air turbine (small vanes machined into the periphery of the rotor) actuated by a rubber-bulb blower similar to that of a medicinal spray apparatus. Connected with the rotating drum is a speed counter by means of which the speed of the object can be determined without any actual contact with it. The weight of the instrument is 10 oz. without, and 17 oz. with the speed counter. It is stated that speeds can be measured within an error of 0.2 per cent.

A simple, compact (2¾-in. diameter) and light (10 oz.) stroboscope is the Strobo-Meca (Ref. 14) intended primarily for use as a tachometer. The instrument is driven by clockwork and the governor of the driving motor can be set to any desired speed by means of a large knurled nut on the periphery of the instrument. The moving (rotating or oscillating) object is viewed through a monocular eyepiece and the governor is adjusted until the object appears to be stationary. An index-mark on the ring then shows the speed of the object on the graduated periphery of the instrument.

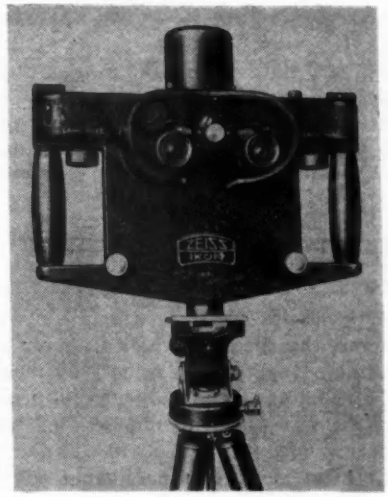


Fig. 4a—Set-up of Zeiss-Ikon Stroboscope on a tripod

The Zeiss-Ikon stroboscope (Figs. 4 and 4a, Ref. 9) also is a binocular instrument. A single disc is mounted di-

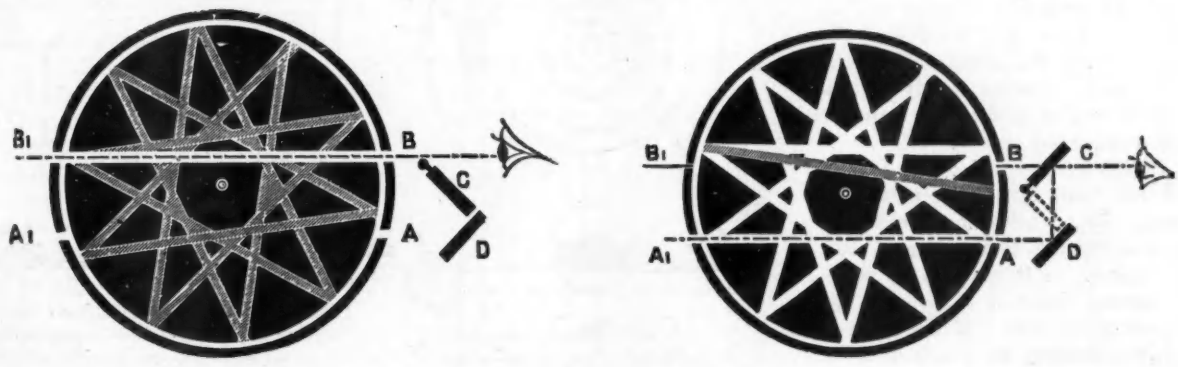


Fig. 3—Principle of the Whidbourne Stroboscope. a, (Left) one glimpse per revolution; b, (Right) ten glimpses per revolution

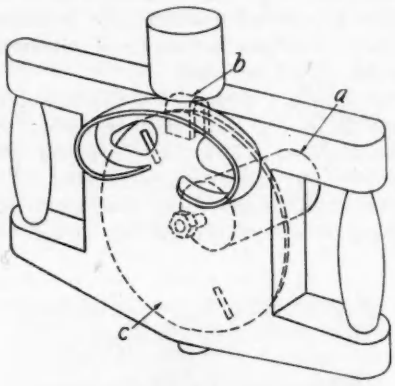


Fig. 4 — Diagrammatic view of Zeiss-Ikon Stroboscope. a, Universal motor; b, eddy-current brake; c, slit disk

rectly on the shaft of a small electric motor, the speed of which is finely adjustable (up to 2500 r.p.m.) by means of a rheostat and an eddy-current brake. Discs with different numbers of slits are provided (1, 2, 3, 6, 10, 12, and 24 slits) and are interchangeable on the motor shaft; those with a small number of slits are intended for the study of comparatively low-frequency motions. and those with a large number of slits for high frequency motions (up to 1000 cycles per sec.). The slit disc also serves as a flywheel for the small motor. By means of a built-in tachometer, speeds up to 120,000 r.p.m. can be determined, without, of course, touching the object. A valuable feature of this instrument is that a prismatic binocular telescope can be fitted to it which enables one to observe the object at a distance and gives an enlarged picture. This makes possible the observation of small objects or of objects that cannot be approached with safety (airplane propellers). In such cases intensive illumination of the object is necessary, and a high-power reflector lamp can be attached directly to the instrument. Like the Ashdown, the Whidbourne and the Strobo-Meca, the Zeiss-Ikon is a portable, handy instrument which can be held in the hand or preferably mounted on a tripod.

The Rotoskop, invented by D. Thoma in 1912 and built by the Voigtlaender und Sohn Co., while not strictly a stroboscope, belongs to the same group of instruments, as it permits of viewing a rotating object in a state of apparent rest (Ref. 10). If the body *b* (Fig. 5a), rotating at a speed *n*, is viewed through the system of mirrors *x*, *y*, and *z* rotating coaxially and in the same sense, at a speed *n/2*, then the rotating body will appear to the observer as standing still. In the actual instrument a single prism *p* is used, instead of the three mirrors (Fig. 5b). This is a so-called Dove prism, which permits of rectilinear vision; that is, the central ray of a light beam, entering the prism on one side, leaves the other side with its direction unchanged. For the investigation of a portion of the peripheral region of a rotating body the arrangement shown in Fig. 5c can be used. Besides the housing containing the prism and running on ball bearings, the actual instrument (Fig. 5) incorporates means for accurate coaxial setting (adjusting screws *i* and *b*, plate-glass windows *d* and *h* with cross-marks on them, and spirit level *a*), the flywheel *g* and the driving elements (gear train *e*, flexible shaft *f* and sensitive brake *c*).

This instrument has been successfully used by Thoma for the observation of flow phenomena in turbines, and it ap-

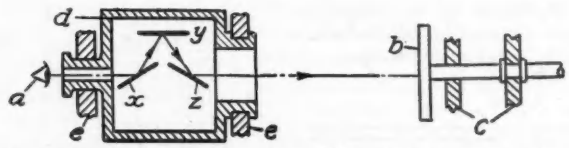


Fig. 5a—Principle of Thoma Rotoskop with three mirrors

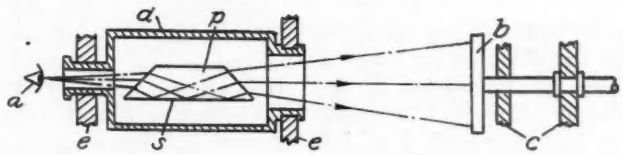


Fig. 5b—Principle of Thoma Rotoskop with Dove prism

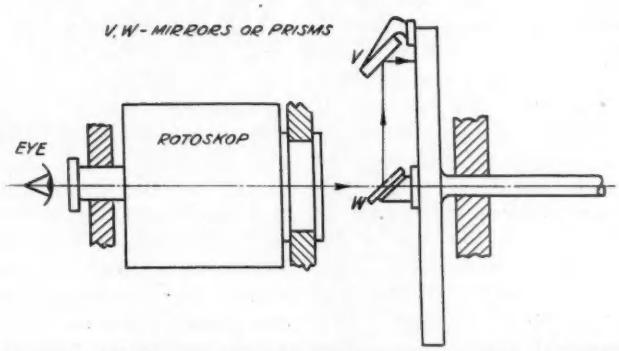


Fig. 5c—Application of the Thoma Rotoskop in the investigation of the periphery of a wheel

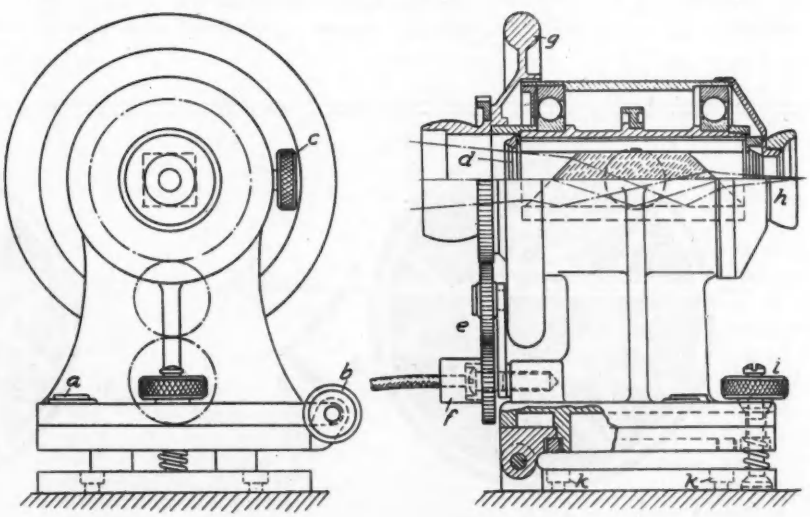


Fig. 5—Thoma Rotoskop, showing actual construction

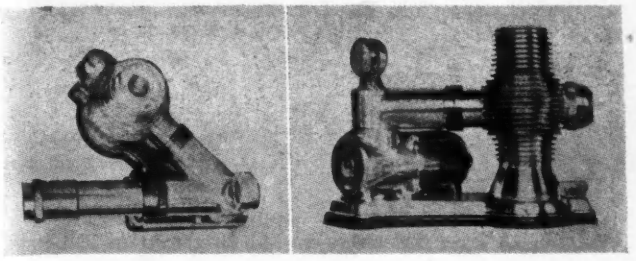


Fig. 6 — The Tackiscope

pears applicable also in other fields of research involving objects in a state of pure rotation. At Massachusetts Institute of Technology it is being used in cavitation research on flow phenomena in turbines and centrifugal pumps.

Stroboscopes with Interrupted Illumination

This group of stroboscopes has the advantage of greater convenience, because the observer's eye is unobstructed and he can move about the object freely. Furthermore, a number of persons can view the object simultaneously. A disadvantage is that it requires a darkened room, or at least subdued light, for best results.

All of the stroboscopes so far described are adapted in principle to use with interrupted illumination by placing a light source behind the slit or window. This method, however, is rather wasteful of light, as only a minute fraction of the total amount of light can be utilized. The stroboscope of Seguin employs this principle in the investigation of the vibrations of the human vocal chord (Ref. 11).

The so-called Tackiscope (Fig. 6, Ref. 12) represents a refinement of this method. In this instrument a high-powered lamp is used in connection with a rotating mirror, driven by electric motor at variable speed, which mirror flashes the light onto the object to be observed. This method does away with the use of a large disc, but there remains the need for a very intense source of light, most of the light flux being wasted.

A more suitable method of interrupted illumination is by electric discharges, either in the form of a spark or through glow tubes. Such discharges are of extremely short duration and very bright while they last.

The simplest stroboscope of this kind is identical in arrangement with the ignition system of an automobile engine and can, in fact, be readily built up of the parts of a conventional ignition system. It consists of a transformer (ignition coil) the primary circuit of which contains a battery (6 or 12 volts) and an interrupter. This latter must have only one cam, and if a standard ignition interrupter is used all except one of the cams must be ground off. This cam is driven in synchronism (by positive drive or by an adjustable-speed drive) with the motion to be investigated. A condenser shunted across the interrupter prevents sparking at the contact points. An adjustable spark-gap takes the place of the spark plug. Whenever the primary current is interrupted, a high-voltage surge is generated by induction in the secondary winding, which latter then discharges through the spark gap. A secondary voltage is generated also when the primary circuit is "made," but this is much weaker than that induced by the "break," and is not sufficient to jump the spark gap. If the spark is brought close to the point to be investigated (a graduated flywheel, spray, reciprocating piston, valve, etc.), and is also reflected by a mirror, this simple stroboscope gives satisfactory performance and has been used with good success in numerous researches.

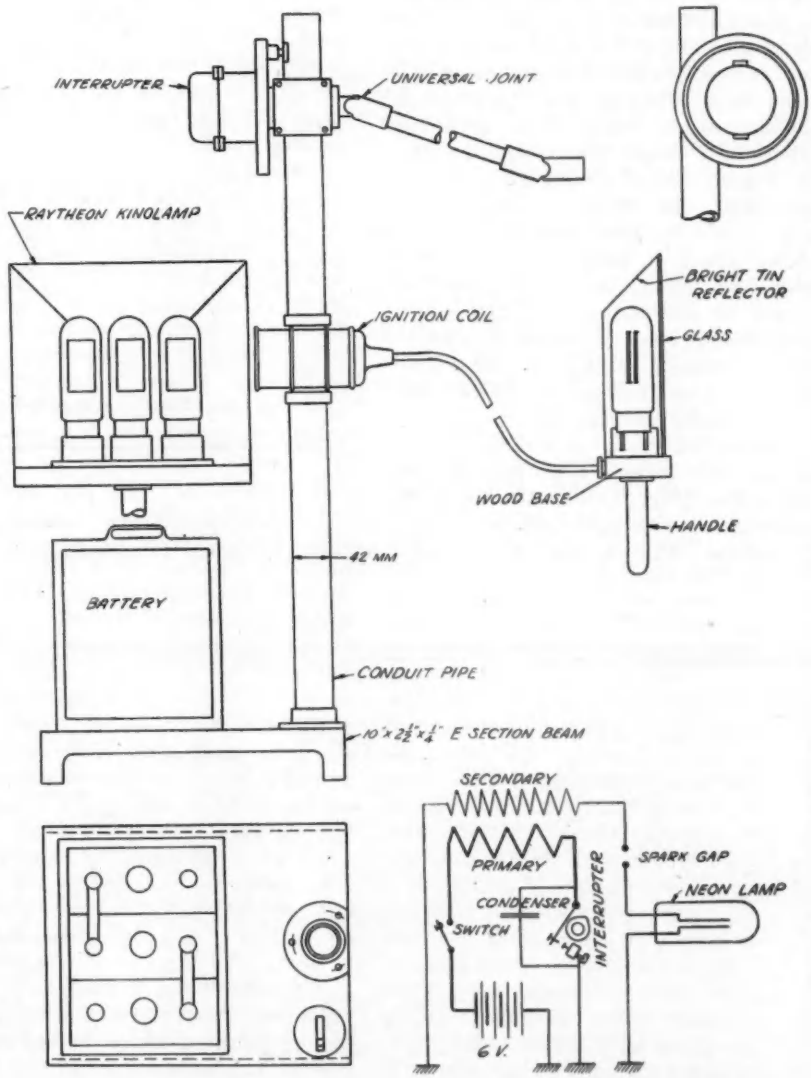


Fig. 7—General arrangement of simple neon-lamp stroboscope (The Pennsylvania State College)

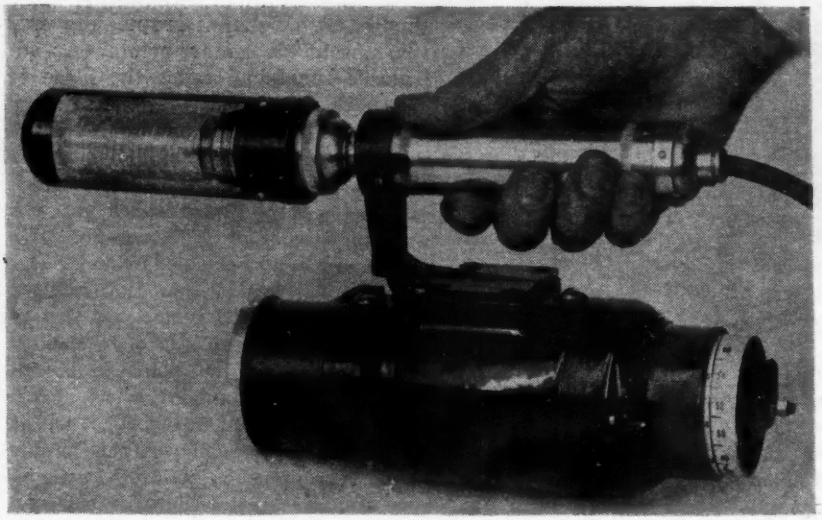


Fig. 8—The Vibroscope of the Electrocon Corp.

frequency of which can be accurately adjusted by a micrometric tensioning screw.

In these simple types of neon-lamp stroboscopes the illumination depends on the primary current used; the larger the primary current, the more intense the illumination. However, the primary current must pass through the breaker points, which when made to carry more than a certain amount of current are subject to pitting and become inaccurate in operation. These considerations limit the magnitude of the current used, and hence, the illuminating power. On account of this limitation, the light of such stroboscopes is not very intense and observations have to be conducted in darkness or semi-darkness.

The light efficiency of a simple spark-stroboscope of this kind can be increased by using a glow tube instead of the spark gap as the light source. Simple neon lamps of the low-voltage type are obtainable at low prices. When these are used in the secondary circuit for stroboscopic purposes, the spark gap must be retained in order to suppress the flash at the "make" of the primary; otherwise a double illumination results. With high-voltage neon lamps such an additional gap is not necessary. A number of neon lamps can be used, connected either in parallel or in series with each other, to increase the intensity of the light. A simple neon lamp stroboscope built by the Engineering Experiment Station of The Pennsylvania State College is shown diagrammatically in Fig. 7.

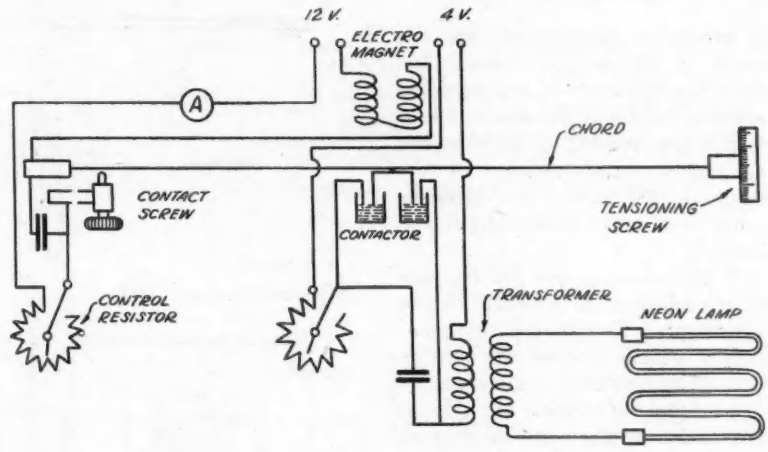


Fig. 9—Circuit-diagram of Guillet Stroboscope

Commercial types of neon-lamp stroboscopes of this type include the Vibroscope (Fig. 8, Ref. 13) using a rotary interrupter head, and the Guillet stroboscope (Fig. 9, Ref. 16), using, as an interrupter, an electromagnetically-operated vibrating cord the

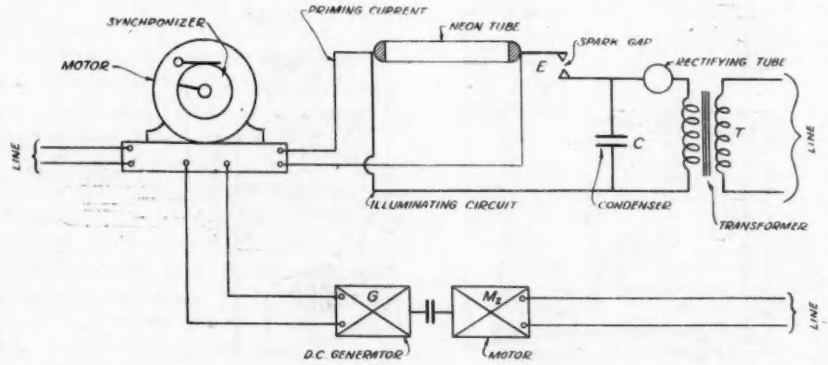


Fig. 10—Circuit diagram of the Stroborama

Far more intense illumination (1000 candle power is claimed) is attained with the "Stroborama" (Ref. 17) developed by the Seguin brothers in Paris, the originators of the Gnome rotary-type aircraft engine. This instrument uses a comparatively powerful lamp, the current for which is controlled not directly by the timing contacts, but by a smaller "priming current." The circuit diagram is shown in Fig. 10. The bank of condensers *C* is kept charged to a potential of 15,000 volts by the high-tension transformer *T* and rectifier tube. These condensers are continuously connected across the neon tube. The voltage is normally insufficient to break down the spark gap *E* and the

(*Turn to page* 678, *please*)

JUST AMONG OURSELVES

Some Fresh Slants On Labor Topics

A WEEK or so ago we had a long talk about labor problems with the manager of one of the conspicuously successful independent tire plants. The conversation covered many of the points being discussed currently in the newspapers in connection with labor hearings, and produced so many fresh points of view that we are going to paraphrase some of them forthwith.

First of all there was the matter of agitators among the working force in the plant. The superintendent we talked to, in answer to a direct question "what do you do with agitators?" said: "We put them on salary, make them foremen, or in some other way take advantage of their latent capacity for leadership. Most of our fellows are on piece rate. When a man goes on salary it identifies him with management in the minds of the other workmen and a lot of his effectiveness as an agitator is lost.

"It's true, too, that the fellow who speaks his piece to the other men often is a born leader, and we figure that we might as well have the advantage of that. There are few men with this talent, given a piece of responsibility, who won't get absorbed in the job and forget about their original grievances. Some of the best foremen we have began as highly vocal kickers."

We asked a fairly obvious question about how the chronic kickers were singled out in the plant. The manager grinned.

"Inside men are the answer to that," he said. "Call them spies, or whatever you want to. We're not ashamed of using them. In my nine years with this plant we have used 'inside men' to advantage—and never against the workmen.

Props Kicked Out From Kickers

"WE feel that we want to know what the grievances are before they simmer through to the top. In many cases we're able to adjust them before they reach the stage of chronic irritations. If we can't do that, we let the grievances take their natural course, and when they do get to this office, at least we know what's coming, and have a better answer ready than we could have otherwise.

"We don't get many real kicks," he continued. "Most of the routine grievances are with the piece rates, which vary widely with the highly specialized operations of tire making. Any operator knows that he can come into my office and raise hell about his rate. He knows, too, that we will make a time study of the operation, and if he's getting the short end of the deal the rate will be adjusted upward. If, on the other hand, the study shows he's making a profit on us, the rate will be adjusted downward."

The plant in which these things hold has many departments in which the average length of service of the workers is from 9 to 14 years. The turnover is kept down to some extent by an ironclad rule that a man who quits can never come back, but this isn't the whole answer.

We went through the plant, and were amazed by the small amount of supervision necessary to continue operations at a high rate. The plant was clean and in a good many departments men and women were working side by side on an equal-pay basis.

"It comes down largely to a matter of the rates," said the manager. "If they are equitable, if they can be adjusted soon enough when there are any inequalities, you don't need to worry about turnover, and supervision costs. They take care of themselves."

We leave it to you.

Value of Informal "Proving Ground"

ON Tuesday, May 12, the Metropolitan Section of the Society of Automotive Engineers will conduct at the Glen Curtiss Airport, in New York, its "proving-ground outing," which has become an annual event of some significance, and which seems to us to embody an idea worthy of extension.

Dealers and factory branches in Metropolitan New York furnish standard passenger car models for trial by members and guests of the section. The airport provides plenty of room, and the section has worked out ground rules and a standard course for the trials, which include sections of smooth road, bumpy road, soft road, and gradient (measured). Each person present at the trials gets an opportunity to drive all the cars under comparable conditions. Results (off the record) are swapped at an evening meeting which follows on the heels of the daytime tests. The meeting this year has a programmed symposium at which the topics will be interiors, accessibility, controls, and riding quality. But, as usual, the most interesting part of the meeting will be the discussion, where individuals will offer informal criticism of the cars which they have tried.

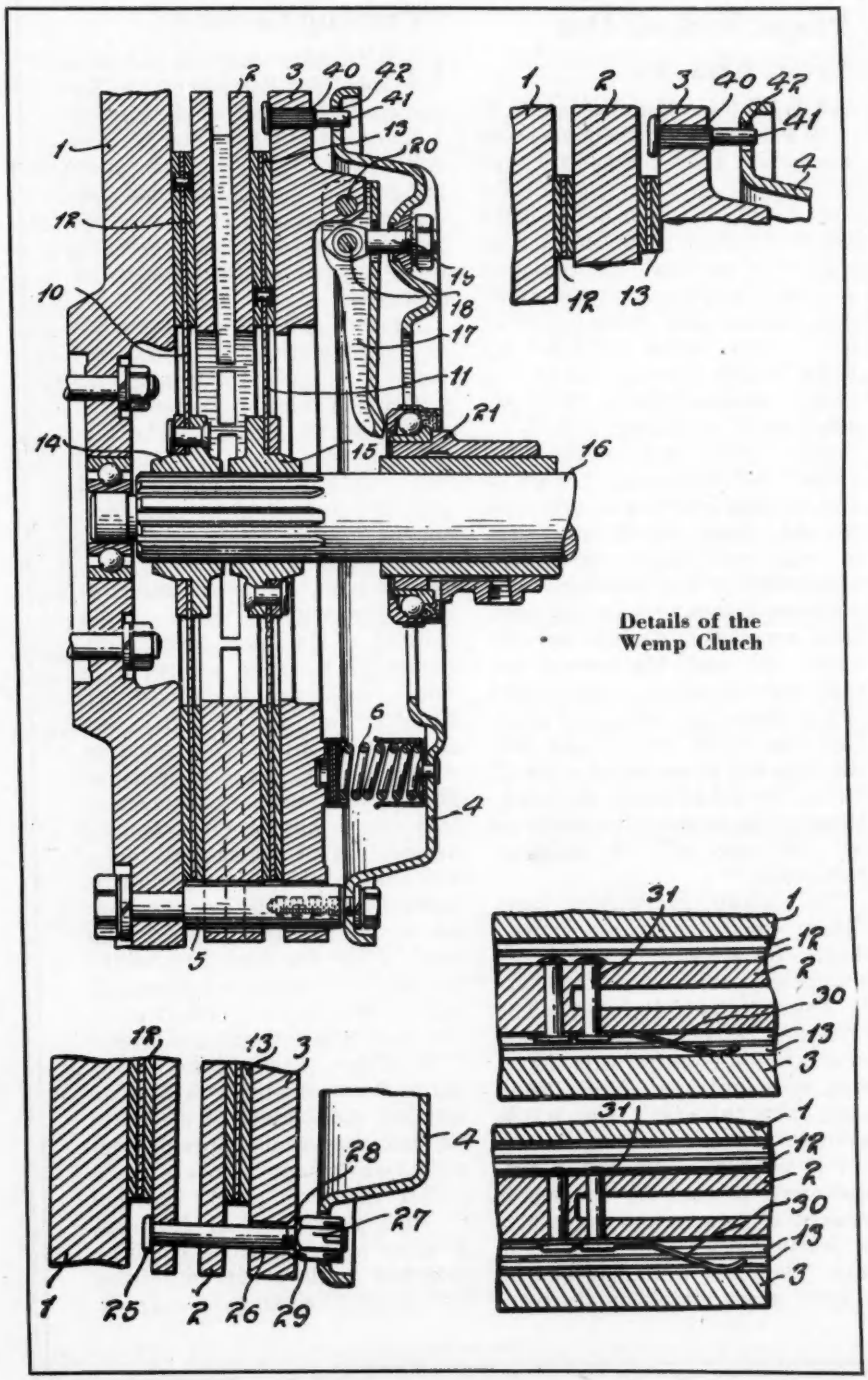
In cities where there is organized responsibility willing to sponsor such trials, it seems to us that they would provide passenger-car manufacturers with a fair index on public reaction to specific mechanical features. Factory representatives could be assigned with profit to "listen in" on such meetings. —H. H.

Clutch—

A NEW clutch structure for multiple disk clutches, aimed to increase the life of clutch facings and to provide a gaging arrangement by means of which the condition of the clutch facings may be ascertained without disassembling the clutch, is the subject of a recent U. S. patent.[1]

The invention represents an improvement on a friction clutch protected the inventor by a previous patent, which comprises a forward-driven disk packed between the engine flywheel and a pressure ring, and a rearward-driven disk packed between this pressure ring and a second pressure ring.

In the clutch as covered by the original patent the rearward disk wore away considerably more rapidly because it is not as effectively cooled as the forward one, which is in contact with the flywheel, and also because it is engaged first, and this resulted in a greater amount of slippage and heat generation on it. In the new clutch the arrangement is such that the forward disk is engaged first, which together with its better cooling facilities tends to equalize the wear on the two disks. A further improvement in the new clutch has the effect of stabilizing the intermediate driving ring 2 when the clutch is disengaged.



Details of the Wemp Clutch

Ring 3 attains some support from the control levers. The ring 2, where it is mounted upon the studs 5, has some clearance for expansion, so that when the clutch is disengaged the pressure ring 2 may shift back and forth relative to the studs 5 striking same and possibly creating noise. The rounded nuts 27 fitting into counterbores 29 tend to centralize the pressure ring 2, and also the springs 30 frictionally tend to resist any abnormal movements of the pressure ring 2 on the studs 5.

The gaging device takes the form of a stud 40 secured to a clutch member such as the pressure ring 3. The stud may have a serrated portion press-fitted into the ring and it may have a projecting gaging end portion 41 arranged to extend through an opening 42 in the cover plate. In the initial set-up, the stud projects through the cover plate. It will be appreciated that as the clutch facings wear and reduce in thickness, the pressure ring 3, in the clutch-engaged position, shifts forwardly toward the flywheel. This shift may be detected by observing the position of the end of the stud 41. One advantageous arrangement is to so locate the parts that when the end of the stud 41 becomes substantially flush with the outside face of the cover plate surrounding the aperture 42, the clutch facings are worn to a point where replacement is necessary.

[1] No. 2,036,005. Clutch Structure. Ernest E. Wemp, Detroit, Mich.

TO improve the low-speed performance of a car by providing a carburetor having a low-speed nozzle directly connected to a main fuel nozzle in such a way that there is no hesitation when transferring from the low-speed nozzle to the main fuel nozzle, is the object of an invention by S. M. Udale.[2]

Referring to the sectional drawing, when the engine is operating at low

Carburetor—Transmission

arouse the inventive engineer to new ideas for new cars to come

speed, with passage P closed, fuel for low-speed operation is discharged from orifices L and M, together with a little air drawn in at F and considerable air drawn in through the opening U-U in the high-speed fuel nozzle H. As the throttle is opened the depression at U increases until no air enters through U, and eventually fuel begins to issue from the openings U and the rate of fuel discharge from L and M begins to decrease. The transfer of the fuel delivery from L and M to U-U is said to be gradual, and this gradual changeover is said to be the gist of the invention. The fuel passages E, D, H, K, L, and M form an inverted U which would act as a siphon if the horizontal leg H were not vented through the openings U-U to the venturi passage J. Location of the low-speed fuel orifices L and M below the fuel level C-C in the float chamber, together with venting of the siphon through the openings U-U, is said to give improved low-speed performance.

[2] Patent No. 2,035,681. Carburetor. Stanley M. Udale, Detroit, Mich., assignor to Milton E. Chandler.

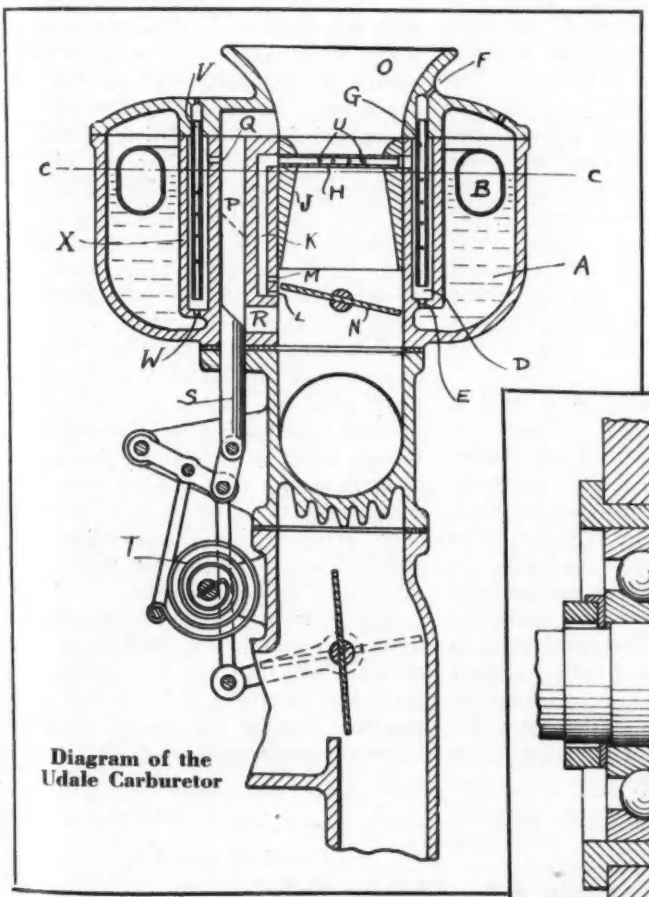
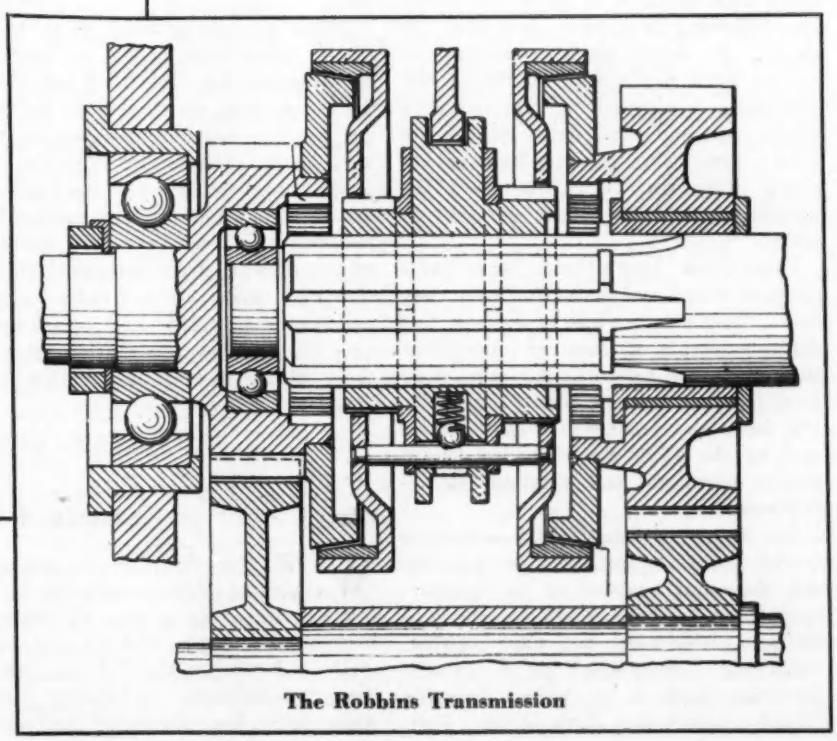


Diagram of the Udale Carburetor

A MECHANISM for the synchronizing of transmission gears previous to their positive engagement has recently been patented.

The patent covers the use of friction clutches of relatively large diameter in combination with friction cones from which the clutches are held free when the mechanism is not in action. The shifter fork, on the other hand, is made of comparatively small diameter, so as to avoid undesirable friction at its contact surface. The toothed clutches effecting the positive engagements also



The Robbins Transmission

are of comparatively small diameter and so formed as to prevent their engagement before they have been synchronized.

The illustration shows the mechanism[3] and the following claim brings out the points of novelty covered by the patent:

A transmission mechanism having an axially fixed gear and a coaxially slidable clutch member, the gear and clutch member having cooperating clutch teeth, a plate secured to the fixed gear and formed with a friction surface, a second plate having a cooperating friction surface, means to mount the second plate slidably but non-rotatably on the clutch member, a peripheral flange on the clutch member adapted to be engaged by shifter mechanism, elongated slots in the flange, supporting rods in the slots, collars on opposite sides of the flange formed with apertures in which the rods are slidable axially, yielding means to center the rods on the flange, and means to mount the second plate on the rods.

[3] Patent No. 2,035,507. Synchronizing Mechanism. Azor D. Robbins, New Brunswick, N. J., assignor to International Motor Co. of New York.

From the Outside Looking In On Automotive Shop Conditions

As the direct result of a preliminary study of the occupations in the automobile industry, the U. S. Department of Labor has published a manual in three volumes entitled "Job Specifications for the Automobile-Manufacturing Industry," prepared by the Occupational Research Program of the Division of Standards and Research.

The first volume contains an introduction and covers operations dealing with the preparation of parts for production, including foundry, forge, sheet metal, heat treat, etc. The second volume covers body construction in many of its details, while the third volume is devoted to general operations, including those on the assembly lines.

In general a single page is devoted to each operation with brief notes on the characteristics of each job under the following headings: Job title, industry or department, summary of duties, work performed, machine-tools-material, qualifications for employment, working conditions, relation to other jobs. This is supplemented in many cases with illustrations of the specific job-station with explanatory notes.

Production executives, particularly the time-study and standards men, may find it well worth while to go over this detail analysis of familiar operations to see how the generalized picture may be fitted to a specific plant. Certainly the form and technique used for presenting the facts may be very useful to the personnel and employment departments.

One aspect of this study deserves the closest scrutiny, not that we question the facts but because of the possible implication of the facts to the uninitiate. We refer to the heading, "Working Conditions," of which the following note is a random sample: "Inside; hot, noisy, dirty, dusty. Hazards—cut from metal, injuries from hammer." This is taken from the job specifications for "Spring Fitter," but the comments in general are no more flattering and in some cases even worse than the foregoing.

We submit that if one unfamiliar with industrial working conditions reads the job specifications, the comments on working conditions seem to be a biting indictment of industry. Yet we all know and accept the fact that when laying a new road, for example, even the civil engineers must don boots and wade through mud and slush. Yes, and no one yet has found a way to tear up city streets without using noisy hammers and without the attendant dust and dirt. Surely it is understood that the operator of a forging hammer works in an atmosphere of noise and heat.

What we are getting at is that it might have been better to leave out these comments, since they are evident to factory men and indeed to the workers, or at least to supplement them with some suitable explanation. The same thing applies to "Hazards," in our opinion, inasmuch as occupational hazards are recognized and necessary steps taken in any enlightened plant to eliminate them. Thus it is that presses are now provided with push-button controls which make it necessary for the operator to hold both hands on the buttons if the press is to go through its cycle. If more than one operator is required, a set of interlocking buttons is supplied so that all hands are out of danger.

Nevertheless, the matter of working conditions merits the closest attention on the part of management. Armed with the evidence in these manuals, it would be advisable to investigate every station in the plant for possible improvement. Air-conditioning or at least the forced draft circulation of filtered air has been coming into the picture recently and may yet play an important part in the manufacturing establishment. Several of the largest foundries in the industry have plans for air-conditioning the entire plant; and there are several examples of forced draft cooling for the operators in heat-treat and forge plants. Obviously, too much attention cannot be paid to the positive elimination of hazards, although much of the danger lies in the attitude of the man himself and from a psychological point of view that has been attacked by the expedient of safety drives which make everyone conscious of a serious problem.

We recommend a thorough study of these job specifications. Perhaps a later revision with the aid of industry experts may provide a valuable and most practical manual for the guidance of industrial management.—J. G.

Standard for Mohair Fabrics

With the purpose of recording standard requirements for mohair pile fabrics so as to give all manufacturers, distributors, and users a worthwhile objective without being restrictive, the National Upholstery Textile Association, Inc., requested the cooperation of the bureau in the establishment of a commercial standard for this type of fabric. It is not expected that a commercial standard will eliminate the manufacture of sub-quality material, but it is expected that the certification

(Turn to page 678, please)

The Horizons of Business

By Joseph Stagg Lawrence

The Counsel of Perfection

NO small part of the nervousness in the stock market during the past week has been due to the renewed vitality of the anti-corporate-thrift tax bill. The bill, 236 pages long, a masterpiece of legal obfuscation, passed the House by a vote of 267 to 93. The new revenue which it may raise is equal to a tenth of the deficit whose existence is one of the arguments for passage of the bill. The real reason for this measure is buried deep in the reform complexes of the New Deal.

The Senate

Be all that as it may. The financial and business community is dismayed to discover that the bill is likely to be passed by the Senate in its present form without any substantial modification. Up to the time the bill passed the House business men comforted themselves with the feeling that Congress was merely demonstrating its complaisance and that the Senate would take this fiscal interloper between thumb and forefinger and drop it in the waste-paper basket. Well-informed newspaper commentators and the special Washington services were practically unanimous on the point. The bill did not have a chance.

The reports apparently have overestimated the strength of the Senate opposition. The statesmen in the Upper House were greatly impressed by the size of the House majority in favor of the measure. Furthermore, the first of May had arrived; the conventions were approaching; the time had come to think about the elections. This was no occasion for a long drawn out battle over a tax bill which had a great deal of political sex appeal and highly plausible economic sanction.

A Good Witness

Mr. Morgenthau confounded the opposition by appearing as the first witness before the Senate Finance Committee armed with a sheaf of papers that contained all the answers. Whenever a question was asked, Mr. Morgenthau reached into a pile of papers and read the answer, chapter, verse and statistical appendices. The interrogators were overwhelmed.

The aides of Mr. Morgenthau were similarly loaded. Said one of the Treasury's top sergeants:

"There are some who, though admitting the inequities of the existing corporation taxes, nevertheless defend it on the ground that the corporate surpluses that are thus built up free from surtaxes serve a public function by enabling corporations to maintain employment at a higher level than would otherwise be possible in periods of depression. Now the most obvious fact bearing upon this argument is that it simply did not work. In 1929 the greatest depression this country has ever experienced came upon us. Not only do we now know that the corporate surpluses accumulated in the '20s were not used to any great extent, in the aggregate, to maintain employment during the depression, but we also have some ground for suspecting that the accumulation of these very corporate surpluses assisted materially in causing the depression. Thus, it has been argued by very respectable economic authority that among the causes of the depression was starving of consumption through the withdrawal of a too large proportion of our funds for corporate capital expenditure."

This statement has more fallacies than a fig has seeds. To our knowledge no one in arguing for the right of management to determine its own dividend policy and its own provision for the rainy day has claimed that such a right would prevent depressions. The claim would be absurd. No one can deny that we had the greatest depression in our history even though big business in the aggregate did accumulate and carry through the depression very sizable surpluses. However, a reasonable case can be made that the possession and use of these surpluses did mitigate the effects of the depression and made it less severe than it otherwise would have been. It is only necessary to look at the list of corporations which continued to pay dividends even though they did not earn them. Every dollar paid out during the early thirties which had not been earned was simply the postponed distribution of earnings realized in the prosperous years. It is mathematically obvious that if these payments had not been leveled off in this fashion they would have been greater in the late twenties and smaller in the early thirties. In other words, income available for consumption would have been greater in 1928 and 1929 and smaller in 1931 and 1932.

Under Consumption

The argument that a full distribution of earnings in 1929 would have prevented the turn in business is utterly untenable. The depression was caused not by a decline in consumption of every-day non-durable goods such as food and clothing, but by a decline in the construction of capital goods such as homes, new highways, bridges, etc. It has been demonstrated over and over during the depression that the decline in business was essentially a decline in capital goods. Now corporate surpluses are rarely equivalent amounts in cash. They are simply an excess of assets over liabilities resulting from the reinvestment of earnings in plant. Specific assets such as bank deposits or securities may account for most of the excess, but not necessarily. If bank deposits have increased, the surplus earnings have been employed by the bank. If the security account has mounted, then others must have received the cash with which they were purchased. In each case the surplus consists simply of a claim against some special form of property. In no sense is it a form of suspended buying power which the corporation has sealed for future use. In ninety-nine cases out of a hundred the buying has already been done and the earnings have passed into circulation.

Flexibility

However, the special claim against the bank, against the market (when securities are owned) or against its own assets when the surplus is simply the accounting difference between assets and liabilities (the usual form of the surplus) gives management a flexibility which varies directly with the size of

(Turn to page 677, please)

Mechanical Specifications

These Specifications are brought Up-to-Date Each Month by the

Line Number	MAKE AND MODEL	Lowest Priced 4-door Sedan	Wheelbase (Ins.)	Tire Size (Ins.)	ENGINE: No. of Cylinders, Bore and Stroke	Taxable H.P.	Piston Displacement (Cu. Ins.)	Maximum Brake H.P. at Specified R.P.M.	Compression Ratio (to—1.)	Displacement Factor ††	Cylinder Head Material	Camshaft Drive Make	Piston Material	Oil Cleaner Make	Air Cleaner Make	Carburetor Make	Muffler Make	Electrical System Make	Battery Make	CHASSIS: Clutch Type and Make	Gearset Make	Universals Type and Make	Rear Axle Type and Make	Service Brake Type and Make
1	Auburn.....654	$ 795	120	6.00/16	6-3 1/16x4 3/4	22.5	209.9	85-3500	6.20	37.4	Al..	Whit.	Al...	Pur..	AC..	Str....	Buf..	A..	USL.	P.Long..	WG..	Nb-Mec	1/2 Col..	BH..
2	Auburn.....852	1095	127	6.50/16	8-3 1/16x4 3/4	30.0	279.9	115-3600	6.50	41.4	Al..	Whit.	Al...	Pur..	AC..	Str....	Buf..	A..	USL.	P.Long..	Det..	Nb-Mec	1/2 Col..	BH..
3	Auburn.....SC852	1545	127	7.00/16	8-3 1/16x4 3/4	30.0	279.9	150-4000	6.50	....	Al..	Whit.	Al...	Pur..	AC..	Str....	Buf..	A..	USL.	P.Long..	Det..	Nb-Mec	1/2 Col..	BH..
4	Austin.....	...	75	3.75/18	4-2.2x3	7.8	45.6	13-3200	5.30	....	CI..	Spir..	Al...	No..	No...	Til....	Buf..	A..	USL.	P.Rock..	WG..	F-Spi...	1/2 Sal..	M.m.
5	Buick.....36-40	885	118	6.50/16	8-3 1/16x3 7/8	30.6	233.0	93-3200	5.65	39.6	CI..	LB..	Ala..	No..	AC..	Str....	Wal..	D...	Del..	P.Own..	Own.	m-Spi...	1/2 Own..	OH..
6	Buick.....36-60	1090	122	7.00/15	8-3 1/16x4 1/8	37.8	320.2	120-3200	5.45	....	CI..	LB..	Ala..	AC..	AC..	Str....	Wal..	D...	Del..	P.Own..	Own.	m-Spi...	1/2 Own..	OH..
7	Buick.....36-80	1255	131	7.00/16	8-3 1/16x4 1/8	37.8	320.2	120-3200	5.45	40.7	CI..	LB..	Ala..	AC..	AC..	Str....	Wal..	D...	Del..	P.Own..	Own.	m-Spi...	1/2 Own..	OH..
8	Buick.....36-90	1695	138	7.50/16	8-3 1/16x4 1/8	37.8	320.2	120-3200	5.45	....	CI..	LB..	Ala..	AC..	AC..	Str....	Wal..	D...	Del..	P.Own..	Own.	m-Spi...	3/4 Own.	OH..
9	Cadillac.....V8-60	1695	121	7.00/16	8-3 5/16x4 1/16	36.4	322.0	125-3400	6.25	45.7	CI..	Mor..	Ala..	No...	AC..	Str....	Old..	D...	Del..	P.Long..	Own.	Nb-Mec	1/2 Own..	BH..
10	Cadillac..V8-70 & 75	2445	131-38	7.50/16	8-3 1/16x4 1/16	39.2	346.0	135-3400	6.25	(a)	CI..	Mor..	Ala..	No...	AC..	Str....	Old..	D...	Del..	P.Long..	Own.	Nb-Mec	1/2 Own..	BH..
11	Cadillac..V12-80 & 85	3145	131-38	7.50/16	12-3 1/16x4	46.9	368.0	150-3600	6.00	(b)	CI..	Mor..	Ala..	Han..	AC..	DL....	Old..	D...	Del..	P.Own..	Own.	Nb-Mec	1/2 Own..	BH..
12	Cadillac.....V16-90	7250	154	7.50/17	16-3x4	57.5	452.0	185-3800	6.00	43.7	CI..	Mor..	Ala..	Cu...	AC..	DL....	Own.	D...	D..	dp.Own..	Own.	Nb-Mec	3/4 Own..	KP..
13	Chevrolet..Mas. Con.	640	113	5.50/17	6-3 5/16x4	26.3	206.8	79-3200	6.00	35.2	CI..	Own.	CI...	No...	AC..	Car....	Own.	D...	D....	P.Own..	Own.	m-Own..	1/2 Own..	OH..
14	Chevrolet..Mas. Ind.	.....	113	5.50/17	6-3 5/16x4	26.3	206.8	79-3200	6.00	34.6	CI..	Own.	CI...	No...	AC..	Car....	Own.	D...	D....	P.Own..	Own.	m-Own..	1/2 Own..	OH..
15	Chevrolet.....Std.	575	109	5.25/17	6-3 5/16x4	26.3	206.8	79-3200	6.00	39.5	CI..	Own.	CI...	No...	AC..	Car....	Own.	D...	D....	P.Own..	Own.	m-Own..	1/2 Own..	OH..
16	Chrysler.....Six	875	118	6.25/16	6-3 5/16x4 1/16	27.3	241.5	93-3400	6.00	41.5	CI°.	Ch...	Ala..	Pur..	Bur..	Car....	NS..	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
17	Chrysler...DeLuxe 8	1045	121	6.50/16	8-3 1/16x4 1/16	33.8	273.8	105-3400	6.20	43.3	CI°.	Ch...	Ala..	Pur..	AC..	Str....	NS..	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
18	Chrysler...Airflow 8	1345	123	7.00/16	8-3 1/16x4 1/16	33.8	323.5	115-3400	6.20	41.8	CI°.	Ch...	Ala..	Pur..	AC..	Str....	Bur..	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
19	Chrysler..Air. Imp. 8	1475	128	7.50/16	8-3 1/16x4 1/8	33.8	323.5	130-3400	6.50	42.4	Al..	Ch...	Ala..	Pur..	AC..	Str....	Bur..	A..	Wil..	P.B&B..	Otwg.	Nb-UP..	1/2 Own..	LH..
20	Chrysler..Af.Cus.Im.8	.....	137	7.50/16	8-3 1/16x4 1/8	33.8	323.5	130-3600	6.50	....	Al..	Ch...	Ala..	Pur..	AC..	Str....	Bur..	A..	Wil..	P.B&B..	Otwg.	Nb-UP..	1/2 Own..	LH..
21	Cord.....810	1095	125	6.50/16	8-3 1/16x3 3/4	39.2	288.6	125-3500	6.50	....	Al..	Whit.	Al...	No...	AC..	Str....	Buf..	A..	USL.	P.Long..	Own.	.....	Tu Own	LH..
22	De Soto..Airstream 6	810	118	6.25/16	6-3 5/16x4 1/16	27.3	241.5	93-3400	6.00	(c)	CI°.	Ch...	Ala..	Pur..	Bur..	Car....	NS..	A..	Wil..	P.B&B..	WG..	Nb-UP..	1/2 Own..	LH..
23	De Soto....Airflow 6	1095	115 1/16	6.50/16	6-3 1/16x4 1/16	27.3	241.5	100-3400	6.50	35.6	Al..	Ch...	Ala..	Pur..	AC..	Car....	NS..	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
24	Dodge.....Six	735	116	6.00/16	6-3 1/16x4 3/8	25.3	217.8	87-3600	6.50	40.0	CI..	Ch...	Als..	Pur..	AC..	Str....	NS..	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
25	Duesenberg.....J	.....	142-153 1/16	7.00/19°	8-3 3/4x4 3/4	45.0	419.7	320-4200	5.20	....	CI..	LB..	Al...	Pur..	Y...	Str....	.....	D...	Exi..	dp.Long.	Own.	m-Spi...	1/2 Own..	PH..
26	Ford.....V8	580	112	6.00/16	8-3 1/16x3 3/4	30.0	221.0	85-3800	6.30	41.2	Al..	Gear	Al...	No...	Yes	Str....	Own.	O...	Own.	P.Os....	Own.	m-Own..	3/4 Own..	OM..
27	Graham.....6-80	665	111	6.00/16	6-3x4	21.6	169.6	70-3500	6.80	37.1	Al..	LB..	Als..	No...	AC..	Mar...	Old..	D...	Wil..	P.Ill....	WG..	Nb-Spi..	1/2 Spi..	OH..
28	Graham.....6-80A	625	111	5.25/17	6-3x4	21.6	169.6	70-3500	6.80	....	Al..	LB..	Als..	No...	AC..	Mar...	Old..	D...	Wil..	P.Ill....	WG..	Nb-Spi..	1/2 Spi..	OH..
29	Graham.....6-90	795	115	6.00/16	6-3 1/16x4 3/8	25.3	217.8	85-3300	6.70	39.7	Al..	LB..	Als..	No...	AC..	Mar...	Old..	D...	Wil..	P.Ill....	WG..	Nb-Spi..	1/2 Spi..	OH..
30	Graham.....6-90A	745	115	6.00/16	6-3 1/16x4	25.3	199.1	80-3300	6.70	44.2	Al..	LB..	Als..	No...	AC..	Mar...	Old..	D...	Wil..	P.Ill....	WG..	Nb-Spi..	1/2 Spi..	OH..
31	Graham S. C 6, 110	895	115	6.25/16	6-3 1/16x4 3/8	25.3	217.8	112-4000	6.70	....	Al..	LB..	Als..	Fram	AC..	Mar(s).	Old..	D...	Wil..	P.Ill....	WG..	Nb-Spi..	1/2 Spi..	OH..
32	Hudson.....6-63	785	120	6.00/16	6-3x5	21.6	212.0	93-3800	6.25	39.3	CI.°	Ge°..	Al...	No...	AC..	Car....	Old..	A...	Nat..	P.Own†	Own.	Nb-Spi..	1/2 Own..	BH..
33	Hudson..8, 64-5-6-7	830	120-127	6.25/16	8-3x4 1/2	28.8	254.0	113-3800	6.00	(d)	CI.°	Ge°..	Al...	No...	AC..	Car....	Old..	A...	Nat..	P.Own†	Own.	Nb-Spi..	1/2 Own..	BH..
34	Hupmobile....618-G	855	118	6.00/16	6-3 1/16x4 1/4	29.4	245.3	101-3600	5.75	45.4	CI..	Mor..	Als..	No...	Bur..	Car....	Old..	A...	Wil..	P.B&B..	WG..	Nb-Spi..	1/2 Spi..	LH..
35	Hupmobile....621-N	1035	121	6.50/16	8-3 5/16x4 3/4	32.5	303.2	120-3500	5.80	47.3	CI..	Mor..	Als..	No...	Bur..	Car....	Old..	A...	Wil..	P.Long..	WG..	Nb-UP..	1/2 Spi..	LH..
36	Lafayette.....3610	675	113	6.00/16	6-3 1/16x4 3/8	25.3	217.7	83-3200	5.61	39.4	CI..	Whit.	Als..	No...	AC..	Str....	.....	A...	USL.	P.B&B..	Own.	Nb-.....	1/2 Own..	BH..
37	La Salle.....36-50	1185	120	7.00/16	8-3x4 3/8	28.8	248.0	105-3600	6.25	39.0	CI..	Whit.	Al...	No...	AC..	Str....	Old..	D...	Del..	P.B&B..	Own.	Nb-Mec	1/2 Own..	BH..
38	Lincoln.....Zephyr	1275	122	7.00/16	12-2 3/16x3 1/4	36.3	267.3	110-3900	6.7	42.5	Al..	Gear	St...	.....	Yes..	Str....	Own.	O...	Own.	P.Os....	Own.	m-Own..	3/4 Own..	MO..
39	Lincoln.....V12	.....	136-145	7.50/17	12-3 1/16x4 1/2	46.8	414.0	150-3400	6.38	41.5	Ala.	Ch...	Ala..	Pur..	Yes..	Str....	Own.	A...	Exi..	P.Long..	Own.	.....	FF Tim	M...
40	Nash....Ambassador	885	125	6.25/16	6-3 5/16x4 5/8	27.3	234.8	93-3400	5.70	36.8	CI..	Whit.	Als..	Own.	AC..	Str....	.....	A...	USL.	P.B&B..	Own.	Nb-Mec	1/2 Own..	BH..
41	Nash..Amb. Super 8	995	125	6.50/16	8-3 1/16x4 1/4	31.2	260.8	102-3400	5.25	36.5	CI..	Ch...	Als..	Own.	AC..	Str....	.....	A...	USL.	P.B&B..	Own.	Nb-Mec	1/2 Own..	BH..
42	Nash.....400	740	117	6.00/16	6-3 5/16x4 5/8	27.3	234.8	90-3400	5.61	42.2	CI..	Whit.	Als..	.....	AC..	Str....	.....	A...	USL.	P.B&B..	Own.	Nb-.....	1/2 Own..	BH..
43	Oldsmobile.....F36	795	115	6.50/16	6-3 1/16x4 1/16	26.3	213.3	90-3400	6.00	39.2	CI..	Whit.	Ala..	No...	AC..	Car....	Hay..	D...	D....	P.B&B..	Own.	Nb-Mec	1/2 Own..	BH..
44	Oldsmobile.....L36	910	121	7.00/16	8-3x4 1/4	28.8	240.3	100-3400	6.20	40.2	CI..	Whit.	Als..	No...	AC..	Car....	Buf..	D...	D....	P.B&B..	Own.	Nb-Mec	1/2 Own..	BH..
45	Packard.....36-120B	1075	120	7.00/16	8-3 1/16x4 1/4	33.8	282.0	120-3800	6.50	41.8	Al..	Mor..	Als..	.....	AC..	Str....	Old..	A.	Pre..	P.Long.	Own.	Nb-Mec	1/2 Own.	LH..
46	Packard.....8	2385	127-34-39	7.00/17	8-3 5/16x5	32.5	320.0	130-3200	6.50	37.9	Al..	Mor..	Als..	Pur..	AC..	Str....	Buf..	D‡.	Pre..	P.Long.	Own.	Nb-UP..	1/2 Own..	BP..
47	Packard.....Super 8	2090	132-39-44	7.00/17	8-3 5/16x5	39.2	384.8	150-3200	6.30	40.7	Al..	Mor..	Als..	Pur..	AC..	Str....	Old..	D‡.	Pre..	P.Long.	Own.	Nb-Spi..	1/2 Own..	BP..
48	Packard.....Twelve	3960	138-144	7.50/17	12-3 1/16x4 1/4	56.7	473.0	175-3200	6.40	44.3	Al..	Mor..	Als..	Pur..	AC..	Str....	Old..	A‡.	Pre..	P.Long†.	Own.	Nb-Spi..	1/2 Own..	BP..
49	Pierce-Arrow...1601	3195	138-144	7.00/17	8-3 1/16x5	39.2	385.0	150-3400	6.40	....	Al..	Whit.	Als..	Pur..	AC..	Str....	Buf..	D‡.	Wil..	P.Long.	WG.	Nb-UP..	1/2 Own..	Ste..
50	Pierce-Arrow...1602	3695	138-144	7.50/17	12-3 1/16x4	58.8	462.0	185-3400	6.40	....	Al..	Whit.	Als..	Pur..	AC..	Str....	Buf..	D‡.	Wil..	P.Long.	WG.	Nb-UP..	1/2 Own..	Ste..
51	Pierce-Arrow...1603	4795	147	7.50/17	12-3 1/16x4	58.8	462.0	185-3400	6.40	....	Al..	Whit.	Als..	Pur..	AC..	Str....	Buf..	D‡.	Wil..	P.Long.	WG.	Nb-UP..	1/2 Own..	Ste..
52	Plymouth P1	590	113	5.25/17	6-3 1/16x4 3/8	23.4	201.3	82-3600	6.70	38.8	CI..	Ch...	Ala..	Pur..	Bur..	Car....	NS..	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
53	Plymouth.....P2	660	113	6.00/16	6-3 1/16x4 3/8	23.4	201.3	82-3600	6.70	37.9	CI..	Ch...	Ala..	Pur..	AC..	Car....	Own.	A..	Wil..	P.B&B..	Own.	Nb-UP..	1/2 Own..	LH..
54	Pontiac...Master Six	720	112	6.00/16	6-3 5/16x3 7/8	27.4	208.0	80-3600	6.20	37.6	CHI	Mor..	CHI.	No...	AC..	Car....	Own.	D...	Del..	P.Own..	Own.	m-Own..	1/2 Own..	BH..
55	Pontiac..DeLuxe Six	770	112	6.00/16	6-3 5/16x3 7/8	27.4	208.0	80-3600	6.20	36.8	CHI	Mor..	CHI.	No...	AC..	Car....	Own.	D...	Del..	P.Own..	Own.	m-Own..	1/2 Own..	BH..
56	Pontiac.....Eight	815	116 5/8	6.50/16	8-3 1/16x3 1/2	33.8	232.3	87-3800	6.20	40.0	CHI	Mor	CHI.	No...	AC..	Car....	Own.	D...	Del..	P.Own..	Own.	m-Own..	1/2 Own..	BH..
57	Reo...Fly. Cld. 1936	845	115	6.25/16	6-3 5/16x4 1/4	27.3	228.0	90-3400	6.50	39.4	Al..	Mor..	Als..	Pur..	AC..	Car....	Old..	D...	Wil..	P.B&B..	WG..	Nb-Spi..	1/2 Spi..	LH..
58	Studebaker...Dict. 6	755	116	6.00/16	6-3 1/16x4 3/8	25.4	217.8	90-3400	6.30	42.2	CI..	Dia..	Ly...	No...	Bur..	Str....	Bur..	A...	Wil..	P.B&B..	WG..	Nb-Spi..	1/2 Spi..	LH..
59	Studebaker.Dict. .P1	.....	116	6.00/16	6-3 1/16x4 3/8	25.4	217.8	90-3400	6.30	....	CI..	Dia..	Ly...	No...	Bur..	Str....	Bur..	A...	Wil..	P.B&B..	WG.	Nb-Spi..	1/2 Spi..	LH..
60	Studebaker...Pres. 8	1045	125	6.50/16	8-3 1/16x4 1/4	30.0	250.4	115-3600	6.50	41.6	Al..	Dia..	Ly...	Fram	Bur..	Str....	Bur..	D...	Wil..	P.Long..	WG..	Nb-Spi..	1/2 Spi..	LH..
61	Terrap'..DeL.& Cus.6	670	115	6.00/16	6-3x5	21.6	212.0	88-3800	6.00	(e)	CI°.	Ge°..	Al...	No...	AC..	Car....	Old..	A...	Nat..	P.Own†	Own.	Nb-Spi..	1/2 Own..	BH..
62	Willys.....77	425	100	5.00/17	4-3 1/16x4 3/8	15.6	134.2	48-3200	5.70	....	CI..	LB..	CI...	No...	AC..	Til....	Buf..	A...	USL.	P.B&B..	Own.	m-UP..	1/2 Own..	BM..

ABBREVIATIONS
°—Others Used
*—Generator and Starter Autolite
†—Power Clutch 1/4—Semi-Floating
3/4—Three Quarters Floating
(a)—Mod. 70—41.6; Mod. 75—42.0
Al—Aluminum Als—Anode-processed
Als—Aluminum Alloy with Strut
(b)—Mod. 80—42.5; Mod. 85—41.5
(c)—De Luxe—42.2; Cust.—42.5
Ch—Chain

CHL—Chrome Nickel Iron
Ci—Cast Iron
(d)—De Luxe—44.2; Cust.—43.7
dp—Double Plate
(e)—De Luxe—40.7; Cust.—40.2
F—Fabric FF—Full Floating
m—Metal Ly—Lynite
N—No or None
Nb—Needle Bearing
Os-Own—Semi-centrifugal
OT—Overdrive Transmission

P—(Clutch) Single Plate
s—Super Charged Tu—Tubular

ABBREVIATIONS (Make of Units)
‡—Owen-Dyneto for Generator and Starter
††—Displacement factor computed on basis of displacement, gear ratio, effective tire diameter and weight with normal load.
A—Autolite AC—AC Spark Plug
B&B—Borg and Beck

B&B—Ball and Ball (Carter)
BH—Bendix Hydraulic Operated
BM—Bendix Mechanical (Brakes)
BP—Bendix Power Operated (Brakes)
Buf—Buffalo Pressed Steel
Bur—Burgess Car—Carter
Ch—Champion Col—Columbia
Cu—Cuno D—Delco-Remy
Del—Delco Det—Detroit
Dia—Diamond
DL—Detroit Lubricator Co.

Exi—Exide
Fle—Fleming
G—Gemmer (Steering)
Glo—Globe
Han—Handy
Hay—Hayes-Ind.
HM—Hydraulic Mechanics
Ill—Illinois L—Lavine
LB—Link Belt
LH—Lockheed Hydraulic (Brakes)

# of American Passenger Cars

Car Manufacturers and Supersede All Others Previously Published

Steering Gear Make	Compression Pressure at Cranking Speed (Lbs.)	Spark Plug: Make and Type	Rings: No. and Width Comp.	Rings: No. and Width Oil	Piston Pin Diameter	Piston Pin Locked in	Valves: Head Diameter and Seat Angle: Inlet (Ins.)	Inlet Seat Angle (Degrees)	Exhaust (Ins.)	Exhaust Seat Angle (Degrees)	Stem Diameter (Ins.)	Operating Tappet Clearance: Inlet	Exhaust	Inlet Tappet Clearance for Valve Timing	Intake Valve Opens Before or After T.C.: No. of Degrees	No. of Flywheel Teeth	No. Teeth on Flywheel	Ignition: Breaker Points Gap (Ins.)	Spark Plug Gap (Ins.)	Timing: Spark Occurs °TC	No. of Flyw. Teeth Spark Occurs TC	Breaker Housing	Rods Removed From	Crankpin Diameter (Ins.)	Crankpin Length (Ins.)	Capacity Crankcase (Qts.)	Capacity Cooling System (Qts.)	Front Axle: Caster (Degrees)	Camber (Degrees)	Toe-in (Inches)	King Pin Inclination (Degrees)	Line Number
R...	....	Ch-J6	2-1/16	1-1/8 1-5/16	7/8	R..	1 5/16	30	1 11/16	45	.342	010H	.010H	.012	7 1/2B..	2 1/4B.	110	.018	.025	3B..	1B..	Au	B.	2 1/16	1 1/4	6	16	3 1/2-4	1.5	1/8	7 1/2	1
R...	....	Ch-J6	2-1/16	1-1/8 1-5/16	7/8	R.	1 5/16	30	1 11/16	45	.342	010H	.010H	.012	7 1/2B..	2 1/4B.	110	.018	.025	3B..	1B..	Au	B.	2 1/16	1 1/4	8	20	2-3	1.5	1/8	7 1/2	2
R...	....	Ch-J9B	2-1/16	1-1/8 1-5/16	7/8	R..	1 5/16	30	1 11/16	45	.342	010H	.010H	.012	7 1/2B..	2 1/4B.	110	.013	.025	3B..	1B..	Au	B.	2 1/16	1 1/4	8	20	2-3	1.5	1/8	7 1/2	3
O...	....	Ch-C7	2-1/16	1-1/8	1/2	R..	1 1/16	30	1 1/16	30	5/32	003H	.004H	....	TC...	TC..	80	.020	.020	.....	.....	Re	..	1 5/16	1 1/4	4	6	5	1 1/4	1/8 ± 1/32	1 1/2	4
S...	....	AC-H9	2-1/16	2-1/16	5/16	R..	1 13/16	45	1 13/16	45	.371	.015	.015	.019	8B...	3 1/4B.	146	.015	.025	2B..	3/4B..	1/2 A	A.	2	1 1/4	6	13 1/4	3-3 1/2	-1/4-+3/4	1/16-1/8	4	5
S...	....	AC-H9	2-1/16	2-1/16	7/8	R..	1 15/16	45	1 7/8	45	.371	.015	.015	.019	14B..	6B..	156	.015	.025	10B..	4 1/2B.	1/2 A	A.	2 1/4	1 5/8	8	17	1 3/4-2 1/4	-1/4-+3/4	1/16-1/8	5	6
S...	....	AC-H9	2-1/16	2-1/16	7/8	R..	1 15/16	45	1 7/8	45	.371	.015	.015	.019	14B..	6B..	156	.015	.025	10B..	4 1/2B.	1/2 A	A.	2 1/4	1 5/8	8	17	1 3/4-2 1/4	-1/4-+3/4	1/16-1/8	5	7
S...	....	AC-H9	2-1/16	2-1/16	7/8	R..	1 15/16	45	1 7/8	45	.371	.015	.015	.019	14B..	6B..	156	.015	.025	10B..	4 1/2B.	1/2 A	A.	2 1/4	1 5/8	8	17	3/4-1 1/4	-1/4-+3/4	1/16-1/8	5	8
S...	....	AC-K9	2-1/16	2-1/16	7/8	F	1.87	45	1.62	45	.341	AA...	AA...	0	TC...	TC..	156	.015	.026	5B..	.....	Ad	A.	2.46	2 1/16	7	30	1 1/2-2	1/4-1	0-1/8	4°5'	9
S...	....	AC-K9	2-1/16	2-1/16	7/8	F	1.87	45	1.62	45	.341	AA...	AA...	0	TC...	TC..	156	.015	.026	5B..	.....	Ad	A.	2.46	2 1/16	7	29	3/4-1 1/4	0-1/4	0-1/8	5°38'	10
S...	....	AC-G6	3-4/64	1-1/16	7/8	P..	1.51	45	1.39	45	11/64	AA...	AA...	0	TC...	TC..	113	.021	.026	4B..	1 1/4B.	Ad	B.	2 1/16	2 1/4	9	19	3/4-1 1/4	0-1/2	0-1/8	5°38'	11
S...	....	AC-G6	3-4/64	1-1/16	7/8	P..	1.51	45	1.39	45	11/64	AA...	AA...	0	TC...	TC..	113	.016	.026	4B..	1 1/4B.	Ad	B.	2 1/16	2 1/4	10	24	1 1/2	1	1/8-5/16	4	12
O...	112	AC-K11	2-1/16	1-5/16	.99	R..	1 41/64	30	1 13/64	30	11/64	.006H	.013H	.006	9B...	3 1/4B.	133	.018	.032	5B..	1 3/4B.	Ad	A.	2 1/16	1 1/2	5	15	3 ± 1/2	1 ± 1/2	1/4-1/16	‡	13
O...	112	AC-K11	2-1/16	1-5/16	.99	R..	1 41/64	30	1 13/64	30	11/64	.006H	.013H	.006	9B...	3 1/4B.	133	.018	.032	5B..	1 3/4B.	Ad	A.	2 1/16	1 1/2	5	15	0	1/4	1/16 ± 1/16	7 3/4	14
O...	112	AC-K11	2-1/8	1-5/16	.99	R..	1 41/64	30	1 13/64	30	11/64	.006H	.013H	.006	9B...	3 1/4B.	133	.018	.032	5B..	1 3/4B.	Ad	A.	2 1/16	1 1/2	5	15	2 3/4 ± 1/2	1 ± 1/2	1/4-1/8	‡	15
G...	....	AC-K9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.010	TC...	TC..	146	.020	.025	TC..	TC..	Au	A.	2 1/16	1 1/16	6	19	1 1/2	†	0-1/16	9 3/4	16
G...	....	AC-K9	2-1/8	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.011	2B..	3/4B..	146	.018	.025	TC..	TC..	Au	A.	2 1/16	1 1/16	6	22	1 1/2	†	0-1/16	5 1/4	17
G...	....	AC-K9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.011	2B..	3/4B..	146	.018	.025	TC..	TC..	Au	A.	2 1/16	1 1/16	6	17	2	††	0-1/16	5	18
G...	....	AC-KL9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.3.6	H .008	H .011	2B..	..3/4B.	146	146	.018	.025	5A..	2A..	Au	A.	2 1/16	1 1/16	6	17	2	††	0-1/16	5	19
G...	....	AC-KL9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.011	2B..	3/4B.	146	.018	.025	5A..	2A..	Au	A.	2 1/16	1 1/16	6	17	2	††	0-1/16	5	20
G...	....	Ch-J9B	2-1/16	1-1/16 1-5/16	7/8	F..	1 13/16	30	1 11/16	45	.342	.010H	.010H	.012	7 1/2B..	.....	.....	.018	.025	3B..	.....	Au	..	.....	.....	.....	.....	.....	.....	.....	.....	21
G...	....	AC-K9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.010	TC...	TC..	146	.020	.025	TC..	TC..	Au	A.	2 1/16	1 1/16	6	19	1 1/16	†	0-1/16	9 3/4	22
G...	....	AC-K9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.010	TC...	TC..	146	.020	.025	5A..	2A..	Au	A.	2 1/16	1 1/16	6	19	2	††	0-1/16	5	23
G...	....	AC-K9	2-1/16	2-1/16	11/64	F	1 17/64	45	1 13/64	45	.340	.006H	.008H	.011	5A...	2 1/2A.	146	.020	.025	4A..	1 1/2A.	Au	A.	2 1/16	1	5	15	2	††	0-1/16	9 1/2	24
R...	....	.....	1-1/16	1-5/16	1 1/16	F.	1 3/32	30	1 1/16	30	11/64	.015C	.015C	.025	6B...	2B..	119	.021	.025	11°B*	.....	Ad	..	2 1/16	1 5/16	12	32	3	1	1/4	....	25
O...	105	Ch-C7	2-4/64	1-4/64	5/16	F	1 11/64	45	1 11/64	45	5/32	.013C	.013C	....	9 1/2B..	3B..	112	.013	.025	4B..	1 1/4B.	Au	A.	2	1 5/16	5	22	7	3/4	1/16-1/8	8 1/4	26
R...	....	Ch-C7	2-1/16	2-5/64	5/16	R.	1 2/64	30	1 1/64	45	5/64	.010H	.010H	.012	4 1/2B..	1 1/2B.	130	.018	.025	2B..	3/4B..	Au	A.	1 1/16	1 1/16	5	11	2 1/4	1	1/8	7 1/4	27
R...	....	Ch-C7	2-1/16	....	11/64	R..	1 2/64	30	1 1/64	45	1/16	.010H	.010H	.012	4 1/2B..	1 1/2B.	130	.018	.025	2B..	3/4B..	Au	A.	1 1/16	1 1/16	5	11	2 1/2	1	1/8	7 1/2	28
R...	....	Ch-14MM	2-1/16	2-5/64	5/16	R..	1 2/64	30	1 1/64	45	5/64	.010H	.010H	.012	4 1/2B..	1 1/2B.	130	.018	.025	2B..	3/4B..	Au	A.	1 1/16	1 1/16	5	15	2 1/2	1	1/8	7 1/2	29
R...	....	Ch-14MM	2-1/16	2-1/16	11/64	R..	1 2/64	30	1 1/64	45	1/16	.010H	.010H	.012	2A...	.....	130	.018	.025	TC...	.....	Au	A.	1 1/16	1 1/16	5	15	2 1/2	1	1/8	7 1/4	30
R...	....	Ch-14MM	2-1/16	2-5/64	11/64	R..	1 2/64	30	1 1/64	45	1/16	.010H	.010H	.012	4 1/2B..	1 1/2B.	130	.018	.025	2B..	3/4B..	Au	A.	1 1/16	1 1/16	5	15	2 1/2	1	1/8	7 1/8	31
G...	....	Ch-J8	2-4/64	2-5/64	3/16	F..	1 5/64	45	1 5/64	45	5/64	.006H	.008H	.010	10 3/4B.	4B..	134	.020	.022	TC..	TC..	Au	A.	1 5/16	1 5/16	5	13	3 1/2-4 1/2	1-1 1/4	0-1/16	7	32
G...	....	Ch-J8	2-4/64	2-5/64	3/16	F..	1 5/64	45	1 5/64	45	5/64	.006H	.008H	.010	10 3/4B.	4B..	134	.020	.022	TC..	TC..	Au	a	1 5/16	1 5/16	7	23	3 1/2-4 1/2	1-1 1/2	0-1/16	7	33
R...	107	Ch-C7A	2-1/16	2-4/64	7/16	F	1 3/64	45	1 1/64	45	.340	.010	.013	.014	2B..	1/2B..	112	.018	.028	7B..	2 1/2B.	Ad	A.	2 1/16	1 1/4	6	18	1 1/2	1	1/16-5/16	7 1/16	34
G...	113	Ch-C7A	2-1/16	2-4/64	7/16	F.	1 3/64	45	1 1/64	45	.340	.006	.013	.010	1A...	1/4A..	109	.016	.028	7B..	2 1/4B.	Ad	B.	2 5/16	1 1/4	8	21 1/2	1 1/2	1 1/4	1/16-5/16	8 1/2	35
G...	100	AC-G8	2-1/16	1-1/16 1-5/16	7/8	F..	1 11/64	45	1 11/64	45	.341	.015	.015	.015	5A...	1 1/2A.	104	.020	.023	10B..	3B..	Au	A.	2	1 13/16	7	19	2 1/2	1 3/16	1/8	7	36
S...	....	AC-K9	2-1/16	1-1/16 1-5/16	11/64	P...	1 5/16	30	1 13/64	45	11/64	.006C	.009C	.015	6A...	2 1/16A.	145	.015	.025	8B..	3 1/4B.	Au	B.	2 1/4	1 3/16	7	16 1/2	2	1	1/8	4 1/16	37
O...	105	Ch-J9	2-4/64	1-4/64	....	....	1.54	45	1.54	45	.311	....	....	....	....	....	....	....	....	....	....	....	....	2 1/16	....	6	27	7	3/4	1/16-1/8	8 1/4	38
O...	105	Ch-7	2-1/16	2-4/64	7/8	P...	1 5/16	45	1 5/16	45	5/16	.004C	.006C	.004	21B..	6 3/4B.	116	.020	.022	7B..	2 1/4B.	Au	B.	2 1/2	1	12	32	1 1/2	1	1/16-1/8	7 1/2	39
G...	100	AC-K12	2-1/16	1-1/16 1-5/16	7/8	F..	1 3/4	45	1 1/2	45	.372	.015H	.015H	.015	.....	.....	.....	.020	.025	.....	.....	.....	A.	2	1 7/16	7	17 1/2	2 1/2	1 1/2	1/8	7	40
G...	90	AC-K12	2-1/16	1-1/16 1-5/16	7/8	F..	1 2/64	45	1 1/64	45	.372	.015H	.015H	.015	.....	.....	.....	.020	.025	15B..	.....	.....	B.	2	1 7/16	8	21	2 1/2	1 1/2	1/8	7	41
G...	100	AC-G8	2-1/16	1-1/16 1-5/16	7/8	F..	1 11/64	45	1 11/64	45	.341	.015	.015	.015	5A...	1 1/2A.	104	.020	.025	10B..	3B..	Au	A.	2	1 13/16	7	18	2 1/2	1 3/16	1/8	7	42
S...	....	AC-G9	2-1/16	2-5/64	11/64	P...	1 5/16	30	1 13/64	45	11/64	.008H	.010H	....	5B....	2B..	145	.020	.033	TC..	TC..	Au	A.	2	1 5/16	6	13	1 1/2-2 1/4	1/16-1	1/16-5/16	5°51'	43
S...	....	AC-G9	2-1/16	2-5/64	11/64	P...	1 5/16	30	1 13/64	45	11/64	.008H	.010H	....	TC....	TC..	145	.015	.033	2B..	3/4B..	Au	B.	2 1/4	1 5/16	7	16	1 1/2-2 1/4	1/16-1	1/16-5/16	5°51'	44
O...	110	AC K-7 or Ch J-8	2-1/16	1-1/16	7/8	F..	1 11/64	30	1 11/64	45	11/64	.007H	.010H	....	7B....	....	140	.020	.029	7B..	2B..	Au	A.	2 1/16	1 5/16	7	18	2	1	1/16-1/8	1 1/2	45
G...	110		2-1/16	1-1/16	7/8	F..	1 1/16	45	1 1/16	45	.340	.004H	.006H	.004	30B..	9 3/4B.	118	.020	.029	6B..	2B..	Au	B.	2 1/16	1 1/16	8	20	1	1	0-1/16	9	46
G...	110		2-1/16	1-1/16	7/8	F..	1 5/16	45	1 5/16	45	.340	.004H	.006H	.004	30B..	9 3/4B.	118	.020	.029	6B..	2B..	Au	B.	2 1/16	1 1/16	9 1/2	22	1	1	0-1/16	9	47
G...	110		2-1/16	1-1/16	7/8	F..	1 1/16	45	1 1/16	45	.340	AA...	AA...	.004	TC...	TC..	118	.020	.029	8B..	2 1/4B.	Au	B.	2 1/16	2 1/4	10	40	1	1	0-1/16	9	48
R...	80	Ch-J6	2-1/16	1-1/16	7/8	F.	1 1/64	45	1 1/64	45	372	AA...	AA...	.010	5A....	1 1/2A.	116	.018	.025	2B..	1/2B..	Ad	A.	2 1/16	1 1/4	10	25	3/4	1	5/8	8	49
R...	85	Ch-J6	2-1/16	1-1/16	7/8	F.	1 2/64	45	1 1/64	45	372	AA...	AA...	.004	19B..	6B..	116	.018	.025	5B..	1 1/2B.	Ad	A.	2 1/16	1 1/8	11	38	3/4	1	5/8	8	50
R...	85	Ch-J6	2-1/16	1-1/16	7/8	F.	1 1/64	45	1 1/64	45	.372	AA...	AA...	.004	19B..	6B..	116	.018	.025	5B..	1 1/2B.	Ad	A.	2 1/16	1 1/8	11	38	3/4	1	5/8	8	51
G...	....	AC-K9	2-1/16	2-4/64	11/64	F..	1 13/64	45	1 13/64	45	.340	.006H	.008H	.011	6A....	2 1/2A.	146	.020	.025	4A..	1 1/2A.	Au	A.	1 5/16	1	5	15	1-3	1/4-3/4	0-1/16	9 1/2	52
G...	....	AC-K9	2-1/16	2-4/64	11/64	F..	1 13/64	45	1 13/64	45	.340	.006H	.008H	.011	6A....	2 1/2A.	146	.020	.025	4A..	1 1/2A.	Au	A.	1 5/16	1	5	15	1-3	1/4-3/4	0-1/16	9 1/2	53
O...	....	AC-K7	2-1/16	1-5/16	5/16	P..	1 11/64	30	1 11/64	45	.310	.010H	.010H	.010	5B....	2B..	139	.020	.025	4B..	1 1/2B.	Au	A.	2	1 7/16	6	15	1-1 1/2	1 1/4-1 3/4	0-1/16	7 1/2	54
O...	....	AC-K7	2-1/16	1-5/16	5/16	P..	1 11/64	30	1 11/64	45	.310	.010H	.010H	.010	5B....	2B..	139	.020	.025	4B..	1 1/2B.	Au	A.	2	1 7/16	6	15	0	0-1/4	0	8 1/4	55
O...	....	AC-K7	2-1/16	1-5/16	5/16	P..	1 11/64	30	1 11/64	45	.310	.010H	.010H	.010	5B....	2B..	139	.018	.025	4B..	1 1/2B.	Au	A.	2	1 7/16	7	16 3/4	0	0-1/4	0	8 3/4	56
R...	85	Ch-C7A	3-4/64	1-1/64	11/16	F..	1 5/16	45	1 5/16	45	11/64	.007H	.008H	.012	5B....	2B..	150	.020	.025	2B..	3/4B..	Au	§	2 1/16	1 1/16	6	18	1 1/2	1 1/16	1/8	8	57
R...	105	Ch-S8	2-1/16	1-5/16	7/16	R.	1 1/16	45	1 1/64	45	11/64	.016C	.016C	.020	15B..	5 1/2B.	130	.020	.025	2B..	3/4B..	Au	A.	2 1/16	1 5/16	6	14	1-1 1/2	1 1/2	1/16-1/8	9 1/2	58
R...	105	Ch-S8	2-1/16	1-5/16	7/16	R.	1 1/16	45	1 1/64	45	11/64	.016C	.016C	.020	15B..	5 1/2B.	130	.020	.025	2B..	3/4B..	Au	A.	2 1/16	1 5/16	6	14	(a)	1 1/2	1/8-1/16	9 1/2	59
R...	105	Ch-S8	2-1/16	1-1/16	7/16	R.	1 1/16	45	1 1/64	45	11/64	.016C	.016C	.020	15B..	5 1/2B.	133	.020	.025	TC..	TC..	Au	A.	1 7/16	1 5/16	8	17.6	(a)	1 1/2	1/8-1/16	9 1/2	60
G...	....	Ch-J8	2-4/64	2-5/64	3/16	F..	1 5/64	45	1 5/64	45	5/64	.006H	.008H	.010	10 3/4B.	4B..	134	.020	.022	TC..	TC..	Au	A.	1 5/16	1 5/16	6	13	3 1/2-4 1/2	1-1 1/2	0-1/16	7	61
L...	....	Ch-C7	3-4/64	1-4/64	7/16	F.	1 1/64	45	1 1/64	45	.371	.004H	.006H	.010	TC....	TC..	96	.018	.025	5A....	.....	Au	A.	1 5/16	1 5/16	4	9	1-2	2	1/8	7 1/2	62

M—Midland Steeldraulic
m—Midland
Mar—Marvel
Mor—Morse **Mun**—Muncie
Nat—National
N—Northeast (Ignition)
Nb—Needle Bearing
NS—Noblitt Sparks **O**—Own
OH—Own Hydraulic
OM—Own Mechanical
Old—Oldberg

Pre—Prest-O-Lite
Pur—Purolator
R—Ross **Rock**—Rockford
S—Saginaw
Sal—Salisbury
Spi—Spicer
Spir—Spiral Gear
Ste—Stewart-Warner
Str—Stromberg
Til—Tillotson
Tim—Timken

UP—Universal Products
Wal—Walker
WG—Wagner Gear Co.
Whit—Whitney
Wil—Willard
Zen—Zenith

ABBREVIATIONS
§ Rods below—Pistons above
† —(—1/4 to+1/2)
†† —(1/2±1/4)
—7 1/16±1
(a)—(—1/4 to+3/4)
*—Measured on rim of flywheel
A—After
A—Above (Rod removal)
(a)—Above or below
AA—Automatic Adjuster
Ad—Advanced **Au**—Automatic
B—(Valve and Ignition timing)—Before
B—Below (Rod removal)
C—Cold (Tappet clearance)

F—Flat
F—(Pin locked in) Floating
H—Hot **L**—Link
Ma—Manual **N**—None
P—(Pin locked in) Piston
R—(Pin locked in) Rod
Re—Retarded
RZ—Rseppa (Gear Grinding Machine Co.)
S—Slide **s**—Sectors
TC—Top Center

Group of 1936 G.M.C. trucks ready for the road after final inspection. This scene was taken in the Pontiac plant.

PRODUCTION LINES

AC Develops New Type Oil Filter

A new oil filter which is said to be capable of cleaning oil and restoring its natural color has been developed by the AC Spark Plug division of General Motors, Detroit. The removable filtering element is composed of a ceramic development known as igneonite, a porous rocky substance which both filters and purifies the oil.

A much longer period between changes is claimed for the new product, and when discoloration appears it is only necessary to remove the top of the filter and replace the element. Oil lines remain connected at all times.

At present the device is available only for trucks, buses and tractors, but development of the passenger car model is virtually complete.

What Hobby

Some people have the most interesting kind of hobbies. Just the other day we chatted with an engineer who is very much of a sculptor and works at it quite energetically. We refer to H. Wollner, Universal Products' chief engineer. He works in clay, mainly, and has fashioned some mighty fine pieces in fairly large size. One of his best is a bust of Henry Ford which has been exhibited publicly.

Buffing Wheels

National Bureau of Standards advises that the existing schedule—Simplified Practice Recommendation R115-30—for full disk buffing wheels has been reaffirmed without change. This establishes a national standard giving a simplified list of diameters for 20-ply wheels which was first adopted in 1929.

Sound Levels

Industrial Standardization for April, 1936, has three important articles on the progress of the program for measuring and labeling sounds, as well as the establishment of standard reference systems. Sound standards are discussed in some detail and illustrated graphically. Reference is made to a project for standardizing the calibration of sound meters so that measurements made with any make of instrument will give the same result.

Air Cushion

A new company is starting operations in Detroit leading to the development of a line of pneumatic seat cushions for cars, buses, trucks, tractors, aircraft, etc. If it takes hold, it may replace the existing spring cushion construction.

Sub-Zero Service

So much has been said about the excellent properties and many uses of stainless steel at elevated temperatures, that freezing or below-freezing applications might be considered almost novel. As a matter of fact, stainless steel retains its strength and toughness at low temperatures that would quickly cause brittleness in ordinary steel and other common metals. Recent experiments show that these qualities are unimpaired even at liquid-air temperatures of approximately 300 deg. F. below zero.

Regimenting Oil

With all the previous history of lubrication theories as a background, it has remained for recent literature to afford an explanation of boundary lubrication on the basis of physico-chemical forces. Two papers on this subject—"Fundamental Chemical and Physical Forces in Lubrication," by Clark, Lincoln, Sterrett, and "Practical Selection of Improved Lubricants," by Davis, Lincoln, Sibley—were read at the last API convention. The two papers have been reprinted in a booklet and are now available for distribution to engineers and research men of the industry. You will find them of great interest in acquiring a background on the modern theory and practical selection of lubricants. Shall we get you a copy?

Heads 'Em

Certain influential manufacturers are getting the first crack at a revolutionary type of bolt header. A single compact machine takes coiled wire at one end—ejects headed and threated bolts or studs, at the other end. This machine may not be ready for the market for another year but we thought you would like to know what's in the offing.

Copper Head

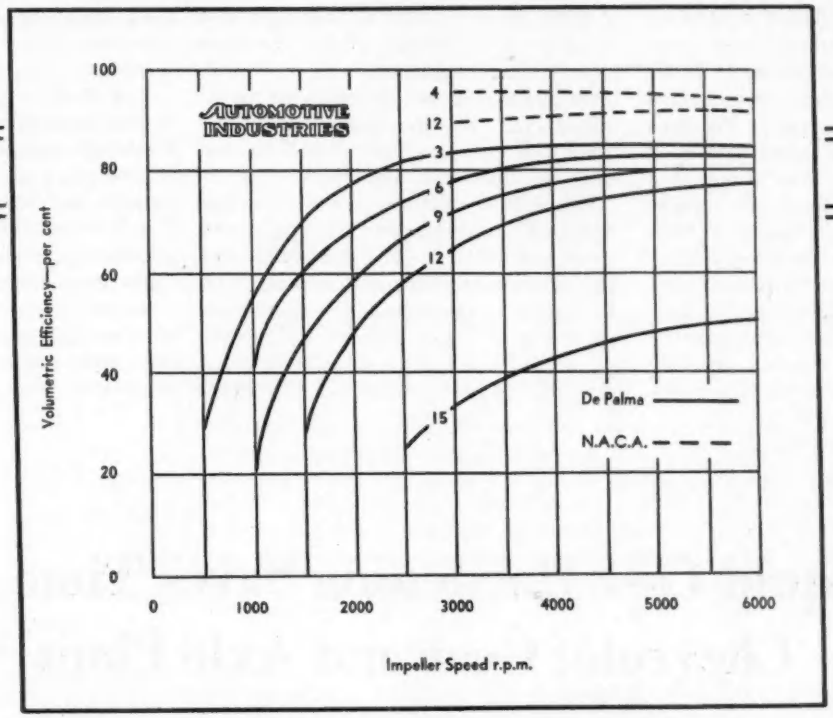
Speaking of special cylinder heads, we understand that one of the outboard engine builders expects to use a copper head on some single and two-cylinder jobs.

J. G.

MANUFACTURING MANAGEMENT METALLURGY

Impellers and Case of Same Metal

Found to be a help in keeping clearance uniform in superchargers



Volumetric efficiency curves for De Palma supercharger

COMPREHENSIVE performance tests on a De Palma Roots-type supercharger have been made at Langley Memorial Laboratory, and a report on these tests is given in Technical Note No. 558 of the N.A.C.A. by Oscar W. Schey and Herman H. Ellerbrock, Jr. Many tests with Roots-type superchargers having aluminum-alloy housings and magnesium-alloy impellers had shown that satisfactory operation cannot be obtained with these over a range of pressure ratios, because of clearance variations. It was thought that this difficulty could be overcome by using impellers of a material having a smaller coefficient of heat expansion than the material of the housing, and that it would be possible to obtain good performance at high pressure ratios by adjusting the clearance to the minimum possible for low pressure ratios. The De Palma supercharger has steel impellers and was designed primarily for use on American Cirrus Mark III engines.

The De Palma supercharger has a displacement of 0.101 cu. ft. (174.5 cu. in.) per revolution and weighs 52 lb. Both it and the N.A.C.A. Roots-type superchargers are designed to operate at much higher speeds than commercial superchargers of the Roots-type. The various parts of the De Palma supercharger housing are made of aluminum alloy, the impeller housing being made in one piece. A baffle is provided in the intake passage, and end plates are doweled and bolted to the housing. Each end plate has two recesses for the ball bearings for the impeller shafts. To each end plate is bolted a cover plate that forms a compartment through which oil can flow and in which some oil is retained for the lubrication of the bearings and gears.

The impeller is made of two steel forgings which are welded together along the tips. A steel shaft with splines on each end is welded in the center of the impeller, and the finished shape is obtained by machining and grinding. The maximum wall thickness of the impeller is 3/16 in. near the center and the minimum is 3/32 in. at the tips. The impeller is 6.34 in. long and 5.58 in. in diameter.

One pair of gears maintains the proper phase relation between the impellers and transmits torque from one impeller to the other. The hub of one of the gears has a slotted projection for direct driving from the engine. In service the De Palma supercharger is lubricated from the engine lubrication system, and in the tests the service lubricating conditions were simulated by the provision of a pressure tank. The supercharger tested had a clearance of about 0.006 in. between impeller tips and case and about 0.004 in. between impeller ends and case.

In the tests the following data were obtained: Temperature of air at right and left orifices (of flow-measuring orifice tank), temperature of air at inlet and outlet of supercharger, room temperature, pressure drop across left and right orifices, pressure in depression tank (in tests with atmospheric pressure at the exhaust), pressure in high pressure tank (in tests with atmospheric pressure at inlet), barometric pressure, speed of dynamometer driving the supercharger, dynamometer scale readings, and clearance measurements.

It was found that the power required by a De Palma supercharger of a size sufficient to compress 1 lb. of air per second at a speed of 3,000 r.p.m. and with a pressure difference of 12 in. of mercury column, is 62.4 hp. The clearance between the impeller tip and the housing in the De Palma supercharger (aluminum housing, steel impeller) increased by 0.003 in. as the pressure difference increased to about 13.5 in. of mercury, while in the N.A.C.A. 8.25 in. supercharger (aluminum housing, magnesium impeller) it decreased by 0.002 in. as the pressure difference increased to about 14.5 in. of mercury. Previous tests with steel and aluminum-alloy impellers had shown that there is a negligible change in clearance due to centrifugal force at speeds less than 3,000 r.p.m. At high pressure differences the supercharger reaches tematures higher than 200 deg. F. and, inasmuch as the coefficient of expansion for annealed steel is roughly one-half that of aluminum alloys, the clearances would be affected in like proportion. The results show that, if a metal of appreciably lower coefficient of expansion is used in the construction of the impellers than is used in the case, the clearances will increase with an increase in pressure ratio. If a metal of greater coefficient of expansion is used in the impellers than is used in the case, the clearances will decrease with an increase in pressure ratio. It follows that, if other factors such as warping and growing of the metals of the case and impellers are neglected, the most uniform clearances can probably be maintained for all operating conditions when the case and the impellers are made of the same material.

Volumetric efficiency curves for the DePalma supercharger over a speed range extending up to 6,000 r.p.m. and for various pressure differences, with atmospheric pressures at the discharge, are shown in Fig. 1. The dotted lines refer to an N.A.C.A. 4-in. blower with atmospheric pressure at the discharge.

That the volumetric efficiency of the DePalma is rather low is ascribed to high slip speed and intake and discharge losses. The results of the tests are said to indicate that:

1. If warping and growing of the metals of the case and impellers are neglected, the most uniform clearances can probably be maintained for all operating conditions when the case and the impellers are constructed of metals that have the same coefficient of expansion. This will reduce the slip losses.

2. A Roots supercharger of 0.101-cu.-ft. displacement should have intake and discharge openings of at least 12 sq. in. in order not to unduly restrict the flow at high speeds.

3. For the DePalma supercharger the volumetric efficiency during tests at high pressure difference is greater when the discharge pressures are higher than atmospheric than when the discharge pressures are equal to atmospheric pressure.

Liquid Case Hardening Saves Time in Chevrolet Gear and Axle Plant

IN the heat treatment of small parts requiring a relatively light case, the gear and axle plant of the Chevrolet Motor Co., Detroit, has found it advantageous and economical to use a liquid case carburizing material instead of the usual pack hardening method. Pack hardening with the special compounds developed by Chevrolet is continued on large parts and all parts which require a thick case.

Liquid case carburizing using Perliton, a product of E. F. Houghton & Co., is the method employed in carburizing brake pawls, speedometer gears and other small parts in the gear and axle plant. Depth of case varies from 0.012 to 0.020 in., depending upon the work. The economy of this procedure may be appreciated from the fact that the time required to produce this depth of case ranges from 1 to 2½ hours, depending upon the desired depth of penetration. With pack hardening practice, the time interval runs from 6 to 7 hours for the same range of penetration.

Since time is important in the cost of manufacture of small parts, the economy of the liquid carburizer is marked. An additional element of cost-reduction is the fact that the small parts can be handled conveniently in baskets or on racks which are carried through the bath, eliminating the time and labor involved in packing and handling carburizing boxes in the usual installation.

Removing basket of small parts from Perliton liquid carburizer bath at the Chevrolet Gear & Axle plant.

The Horizons of Business

(Continued from page 671)

the surplus. The greater the surplus, the more easily may the corporation pursue, over a period of time, a course which is desirable even though expenditures exceed income. The surplus makes it possible for the company to pay wages and dividends when the income of the business does not provide the means. Such practice *tends* toward greater stability. It cannot prevent general depressions.

Unfortunately business is no longer judged by practical standards but by the exacting requirements of perfection. Management with such freedom as it has had in the past has not been able to prevent depressions. Therefore it must resign in favor of doctrinaire planners who in the practical job of making a living have in an impressive number of instances been signally unsuccessful.

Metallurgy of Iron and Steel

THIS second edition, which follows the first edition of Professor Boylston's well-known work after an interval of seven years, has been revised to take account of recent developments in the field which it covers. All statistical tables, for instance, have been brought up to date and in some instances production curves have been substituted for tables. Various processes and items of metallurgical equipment that were introduced in the industry in recent years are covered in the new edition.

Professor Boylston's book covers all three phases of metallurgy, viz., process metallurgy or the winning of the metal from its ores and the refining processes employed in connection therewith; mechanical metallurgy or the process of working steel, and the metallography and heat treatment of steel; but because of the wide scope of the work, the subjects handled naturally are not dealt with in an exhaustive manner and the book, as indicated by its title, is intended to serve as an introduction to metallurgy only.

Operating Principles, Design and Tests

Das Kraftfahrzeug - Betriebsgrundlagen, Berechnung, Gestaltung und Versuch (The Motor Vehicle-Operating Principles, Calculation, Design and Tests), by W. Kamm. Published by Julius Springer, Berlin, Germany.

THIS is a textbook on motor vehicles and is based on lectures by the author, who is professor of motor-vehicle engineering at Stuttgart Technical College. It covers the entire field of motor-vehicle engineering—engines, chassis parts, and bodies—and deals also with tests on engines, fuels, body models (in wind tunnels), etc. The subject is handled strictly from the engineering standpoint and all of the important recent developments in this field seem to be covered, including such items as the use of bottled natural gases as engine fuel, power steering for heavy vehicles, torsion-bar suspension, chassisless passenger cars, piezo-electric indicators, etc. One objection that may be made to the style of treatment is that it is unduly brief, as may be judged from the fact that the entire subject is covered in 235 pages (though it should be pointed out in this connection that the format is rather large and that one page is equal to one-and-a-half pages or more of the usual textbook). Carburetors, for instance, to which subject several authors have devoted whole books, are here covered in four pages; injection pumps for Diesel engines in two. Of course, where the book is used as a text in classroom work it can be suitably supplemented by the instructor.

The Stroboscope at Work in Automotive Research

(Continued from page 766)

tube *N* at the same time. When subjected to a voltage below the critical value which induces ionization, the neon lamp is a practically perfect insulator. The rotary contactor (Synchronizer) repeatedly discharges a small condenser (charged to a few hundred volts by the motor-generator M_2-G) through the primary of a small high-tension transformer. Each time this condenser is discharged, a primary surge of very high voltage is produced which ionizes a small quantity of the neon in the neon tube and breaks down its electrical resistance. As a result, the entire voltage of the bank of condensers *C* is thrown across the spark gap *E*, which is broken down thereby. The condensers then discharge in a surge through the neon tubes, dissipating their stored energy in an intensely brilliant flash of very short duration. As soon as the condensers are discharged, the tube becomes non-conducting again. The condensers *C* are gradually recharged by the transformer *T* and the rectifier, until conditions are ready for the next flash. The constants of the circuit should be such that the condensers will be charged to practically the full supply voltage between flashes.

Standards for Mohair Fabrics

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of quality on the basis of such a commercial standard will stop the undesirable trend toward lower quality and turn it in an upward direction.

The recommended commercial standard as approved by the general conference on June 14, 1935, has been accepted as a commercial standard by producers, distributors, and users of mohair pile fabrics and manufacturers and distributors of upholstered furniture.

The resulting commercial standard, CS52-35, now available in printed form, provides each of three types of mohair pile fabrics, namely 100 per cent mohair plain velvet, 100 per cent mohair plain frieze, and 50 per cent mohair plain frieze. It also sets minimum requirements for the number of tufts (a tuft being described as the two exposed ends of a pile loop) per square inch in mohair velvet and the number of loops per square inch in the friezes; the minimum weight of the pile per yard of fabric 54 inches wide for each type of fabric; sets color-fastness requirements; requires that the fabric shall be treated with a satisfactory moth repellent material; permits a minus tolerance of 1 per cent in the 50 per cent mohair frieze; outlines test methods to determine the above requirements, and records the wording of a certificate to be used on tags or labels to inform the buyer that the fabric conforms to the quality requirements of the commercial standard.

The pamphlet includes a brief history of the project, a list of the official acceptors, and the membership of the standing committee. The standard became effective as a basis for labeling of fabrics complying therewith on July 8, 1935. Copies are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.